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PHILIPPINE NEUROPTEROID INSECTS

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SIX PLATES

The following descriptions and synopses are largely the result of studying the specimens collected in southern Mindanao by Mr. Charles F. Clagg. Much of Clagg's collecting was done on Mount Apo, which has rarely been visited by entomologists. It is not surprising, therefore, that a number of species are new. Some of the new species are among those sent me by the late Charles Fuller Baker shortly before he died.

Nearly all of the known Philippine neuropteroid insects come from either Luzon or Mindanao. Until more is known of those from other islands there is little value to generalizations on distribution. As far as known the species are very different from those of Formosa, but related to those of the Greater Sunda Islands.

PSOCIDÆ

PSOCUS DOLOROSUS sp. nov. Plate 2, fig. 12.

Head dark brown, clothed with short white hair, eyes of female about two and one-half diameters apart; antennæ extremely long, reaching much beyond wings, almost black, clothed with very long hairs; thorax almost wholly black, sutures between lobes pale; abdomen and legs black.

Forewings mostly hyaline on basal part, on apical part mostly dark brown, stigma wholly black and extending behind on basal part, most of areola postica hyaline, only posterior side dark, discoidal cell pale on basal half, veins all dark, the vein closing discoidal cell also dark, forking of radial sector sometimes very

faintly pale, black dot at nodus, and a little before this a brown band obliquely up to medius; hind wings faintly fumose, veins brown.

Stigma rather slender, rounded behind; areola postica narrow above; forks of radial sector fully twice as long as the pedicel, base of radial sector obliquely curved.

Length, to tip of wing, 5.5 mm; antennæ, 8.5.

MINDANAO, Davao Province, Tia Ridge, Mainit River, and Todaya Plateau, all on Mount Apo, altitude 5,000 to 6,500 feet, September 2 to 24 (*Clagg*). Type, Museum of Comparative Zoölogy No. 21743.

PSOCUS ALTICOLUS sp. nov. Plate 1, fig. 8.

Head brown, clothed with short white hair, in female a pale area each side on vertex, eyes of female about three diameters apart; antennæ pale brown, clothed with moderately long hair in female, and very long hair in male; thorax brown, with pale lines between and on sides of the lobes; abdomen brown, somewhat spotted with pale; legs pale.

Forewings hyaline, apical half wholly evenly fumose, leaving the basal third of stigma white, some faint clouds above nodus tend to form a band, and another faint cloud nearer to base, veins largely dark, end of discoidal cell hyaline-white, forking of radial sector also white, also basal fourth of stigmal margin, and on hind margin a white streak for some distance before the nodus. Hind wings scarcely smoky, veins brownish.

Forewing with stigma rather large and broad, almost (but not quite) angulate behind; forks of radial sector almost parallel and longer than pedicel; discoidal cell about one-half as wide at tip as at base; basal part of radial sector curved; areola postica very broad above.

Length, 5 mm.

MINDANAO, Davao Province, Galog River, Tia Ridge, Todaya Plateau, Baroring River, Mainit River, Sibulan River, and Batraeyon, all on Mount Apo, altitude 5,000 to 8,000 feet, August 31 to November 7 (*Clagg*). Type, M. C. Z. No. 21742.

The parallel radial forks are like those of *P. cinereus* Endl., but that species is neither pale on basal part of wings nor as dark on the apical part. Enderlein later put *P. cinereus* in one of his numerous genera split from *Psocus*.

PSOCUS INCOMPTUS sp. nov. Plate 1, fig. 9.

Head brown, sometimes paler on vertex, clothed with short white hair, eyes of male only about one-half diameter apart, of female fully three diameters apart; antennæ dark, in male as

long as wings, in female shorter, densely hairy, in male with very long hair; thorax, abdomen, and legs dark brown. Forewings uniform gray all over, stigma no darker than the rest, veins mostly brown, that closing discoidal cell, the forking of radial sector, medius before end of discoidal cell, and end of cubitus white. Hind wings scarcely darkened, veins brown.

Stigma elongate, rounded behind, the widest part but little beyond middle; forks of radial sector slightly divergent, very much longer than pedicel; discoidal cell not twice as wide at base as at tip; areola postica very long above on medius, usually as long or longer than end of discoidal cell.

Length, 4.5 mm; antennæ, male, 4.5.

MINDANAO, Davao Province, Lawa, May 5; La Lun Mountains, July 5 (*Clagg*). Type, M. C. Z. No. 21741.

Differs from allied forms in the faint and even color of the forewings and in the not darker stigma.

STENOPSOCUS DISSIMILIS sp. nov.

Head yellowish brown, nasus darker, antennæ brown, as long as wings, finely short-haired, thorax brown on the lobes, paler between, clothed with moderately short, white hair like that of head; abdomen brown, legs pale. Forewings hyaline, very faintly fumose, hardly noticeable; veins brown, stigma very pale yellowish; hind wings hyaline, veins brownish.

Forewings with stigma but little longer than greatest length of discoidal cell (shorter than in *S. tonkingensis*), somewhat beyond the middle slightly angulate (at the crossvein), before this the side concave, beyond, convex; forks of radial sector about equal to pedicel, plainly divergent; union of radial sector and medius not quite as long as the basal part of radial sector; discoidal cell about one and one-half times as long as apex; areola postica large, triangular, nearly as high as long, the crossvein to medius only one-half the height of cell (in *S. tonkingensis* much longer). Wing broad and evenly rounded at tip, much as in *S. apertus;* the space between radial sector and medius a little wider before than at the crossvein to areola postica (not as wide, however, as in *S. infirmus*).

Length, 4.5 mm.

MINDANAO, Davao Province, Mount Apo, Tia Ridge, altitude 6,500 feet, September (*Clagg*). Type, M. C. Z. No. 21945.

OPHIODOPELMA MULTIPUNCTATA Hagen. Plate 1, fig. 1.

One from Galog River, Mount Apo, Mindanao, altitude 6,000 feet, November 5, agrees with Hagen's type from Ceylon; I give a figure of the forewing.

Key to the Philippine species of Cæcilius.

1. Forewings with a dark longitudinal streak from near base to tip, often with side branches ..... 2.
   No such marking ..... 6.
2. With a projection from the dark streak across the yellow stigma; all space behind outer median vein dark to the hind margin; space between forks of the radial sector dark ..... *plagosus.*
3. No projection from dark streak towards stigma, nor up along upper branch of radial sector, and almost all of space back of the medius pale ..... *muggenburgi.*
   A projection towards stigma, or up along the upper branch of radial sector ..... 4.
4. No projection towards stigma, but upper branch of radial sector bordered, some clear space between radial sector and medius at apex. *reductus.*
   A projection from the dark streak towards stigma ..... 5.
5. Outer space behind medius practically entirely dark ..... *deceptus.*
   Outer space behind medius largely pale, the branches narrowly bordered with dark ..... *marcidus.*
6. Entire wing dark brown to blackish, no pale spaces whatever, at least in apical half; head and thorax black ..... *claggi.*
   Not wholly dark brown to blackish ..... 7.
7. Forewing with a brown band just before middle, and one from stigma to hind margin where it connects with the brown bordering the outer margin ..... *aridus.*
   No such marks ..... 8.
8. Large species, antennæ plainly with black band at tips of joints, wings slightly fumose ..... *cincticornis.*
   Antennæ not plainly banded ..... 9.
9. Veins pale, plainly dotted with dark, small spots on wing, some tending to form a band behind the stigma; small species ..... *guttulatus.*
   Veins not plainly dotted with dark ..... 10.
10. Antennæ, except base, jet black; no spots on wing ..... *conspicuus.*
    Antennæ wholly pale ..... 11.
11. Wings wholly unmarked, no dot even at nodus or on stigma ..... 12.
    Wings more or less marked with dark ..... 13.
12. Areola postica three times as long as broad .... *Pseudocæcilius innotatus.*
    Areola postica hardly more than twice as long as broad ..... *castillus.*
13. A series of dark marks, one in each marginal cell, stigma broad, mostly dark ..... *Ophiodopelma multipunctatus.*
    No such series of marks ..... 14.
14. Forks of radial sector nearly twice as long as pedicel, areola postica fully twice as long as broad ..... *inæqualis.*
    Forks of radial sector not or scarcely as long as the pedicel ..... 15.
15. Several veins in apical half of wing with small bordering spots, basal part of radial sector not dark, no dark spot over it to medius. *nitoris.*
    No spots on veins in apical part of wing, except in stigma, basal part of radial sector dark or a dark spot over it to the medius, antennæ of male very long-pilose ..... *otiosus.*

CÆCILIUS MARCIDUS sp. nov.

Head in male dark brown, in female paler, eyes in male very large, separated by scarcely more than one-half their diameter, in female by about twice their diameter; antennæ pale, head and antennæ densely clothed with short hair; thorax brown; abdomen paler; legs pale, unmarked.

Forewings with a dark brown streak from base to tip, leaving a wide clear space in front and behind, in apical part but little wider than space between radial sector and medius, which are nearly parallel for most of their length; stigma pale yellowish, a dark spot from the dark streak reaches up to corner of stigma but does not go across, basal part of space between forks of radial sector dark; branches of medius to hind margin bordered with brown, and hind margin of areola postica likewise bordered.

Stigma slightly angulate behind, outer part nearly as long as basal part; areola postica subtriangular, a little longer than high and of moderate size; forks of radial sector not nearly as long as pedicel, but somewhat more than one-half as long; union of radial sector and medius about one-half as long as base of radial sector. Hind wings fumose, except pale outer costal area.

Length, 2.5 mm.

MINDANAO, Davao Province, Calian, June 13 and 17 (*Clagg*). LUZON, Laguna Province, Mount Maquiling (*Baker*). Type, M. C. Z. No. 21749.

In one wing of one specimen the areola postica is connected by a crossvein to the medius.

CÆCILIUS CONSPICUUS sp. nov. Plate 2, fig. 18.

Head pale yellowish, unmarked, hairs extremely minute, eyes of male very large and projecting in front as well as laterally, not quite one-half their diameter apart; basal three joints of antennæ yellowish, beyond antennæ deep black and rather heavy in the male, hairs dense, but short. Thorax with three large shining brown spots above, pleura pale as also legs, unmarked; abdomen pale, but dark above at base and at tip.

Wings hyaline, unmarked, veins yellowish, stigma also pale yellowish. Forewings very long and slender, stigma also very long, but low and broadly rounded behind; areola postica rather small and low, fully twice as long as high; forks of radial sector almost as long as pedicel, union of radial sector and medius about as long as base of radial sector which is curved.

Hind wings with upper branch of radial sector plainly oblique.

Length, 4 mm.

LUZON, Mountain Province, Baguio (*Baker*). Type, M. C. Z. No. 21746.

CÆCILIUS CLAGGI sp. nov. Plate 1, fig. 4.

Head brown to black, with many moderately short hairs, some each side on vertex longer, in female eyes small and nearly three diameters apart, in male eyes very large and only about one diameter apart; antennæ dark, in both sexes with long hairs but those of male about one-half longer than those of female; thorax, abdomen, and legs blackish. Both wings wholly blackish, as also the veins, a slightly paler area in forewing just beyond the end of anal veins.

Forewings rather broad; stigma very long, moderately broad, but rounded behind; areola postica about twice as long as high, evenly rounded above; forks of radial sector not quite as long as pedicel; union of radial sector and medius very short; hairs on margin dense, but not very long.

Length, 3.5 mm.

MINDANAO, Davao Province, Mount Apo, Kidapayan Trail, altitude 7,000 to 8,000 feet, September 20; La Lun Mountains, July 5; Calian, January 1; Lawa, May 5 (*Clagg*). Type, M. C. Z. No. 21747.

CÆCILIUS NITORIS sp. nov. Plate 1, fig. 2.

Head white, unmarked, clothed with rather long hairs, in male the eyes not a diameter apart; antennæ pale, with rather long hair; thorax and abdomen pale brown, legs whitish, unmarked.

Forewings hyaline, with partly pale and partly dark veins; at forking of cubitus from medius several brown spots tending to form a band; small brown spots in base of apical forks, along outer margin of areola postica, at tip of stigma, and in forking of radial sector and medius; one brown spot along medius, and one along radial sector near middle of wing. Beyond the stigma the margin quite broad, and tapering around the tip; stigma elongate, rounded behind; areola postica quite high and short (in one specimen not quite as high as figured); forks of radial sector hardly one-half as long as pedicel; margin of wing with quite long hairs.

Hind wings hyaline, veins pale, upper branch of radial sector transverse.

Length, 2.2 mm.

LUZON, Laguna Province, Mount Maquiling (*Baker*). Type, M. C. Z. No. 21751.

CÆCILIUS OTIOSUS sp. nov. Plate 1, fig. 7.

Head brown, clothed with moderately long hair; eyes of male very large, much less than one diameter apart; antennæ pale, with extremely long hairs; thorax with three large brown spots on the lobes; abdomen brown, legs pale, scarcely marked with dark.

Forewings hyaline, veins pale; outer part of stigma dark and a slight extension behind it, a large dark spot tending to form a band over forking of cubitus and medius, and a dark spot at end of anal veins. Stigma long, rounded behind; areola postica rather high, longer than high, triangular; margin of wing very broad beyond stigma, tapering around tip; forks of radial sector fully equal to pedicel.

Hind wings hyaline, veins brownish.

Length, 2.5 to 3 mm.

MINDANAO, Davao Province, Mount Apo, Mainit River, altitude 6,000 feet, September 10 (*Clagg*). LUZON, Laguna Province, Mount Maquiling (*Baker*). Type, M. C. Z. No. 21750.

Sometimes the basal spot is not so distinct, but the veins here are heavily black; in one specimen (perhaps different) the head is paler and the areola postica is lower.

CÆCILIUS PLAGOSUS sp. nov.

Head black (no pale area on vertex) clothed with short pale hair, eyes of female very small, antennæ pale, with very short hair; thorax dark brown, legs pale. Forewings with a dark streak through from base to tip, and occupying most of wing, in outer part reaching to hind margin, a triangular pale area over basal part of areola postica reaching up to medius, before the end of anals a small pale spot on margin, and before this a large triangular whitish spot reaching two-thirds across wing. Stigma yellow, behind and beyond it a clear area; a dark process from the main dark streak up and across stigma (as in *dolobratus*); stigma angulate behind, the areola postica large, a little longer than high and evenly rounded; forks of radial sector not nearly as long as stalk; union of radial sector and medius about as long as base of radial sector.

Hind wings fumose except outer costal part, but branch of radial sector to margin bordered with brown.

Length, 3 mm.

LUZON, Laguna Province, Mount Maquiling (*Baker*). Type, M. C. Z. No. 21748.

Cæcilius dolobratus has the cell between forks of radial sector pale, areola postica hardly one-half as large, and antennæ dark.

PSEUDOCÆCILIUS INNOTATUS sp. nov. Plate 2, fig. 19.

Head and thorax yellowish brown, head with some fine short hairs and scattered much longer ones, particularly by the side of eyes and on vertex; eyes in male large, hardly one diameter apart, vertex roundly concave (not angularly); antennæ pale yellowish, in male with very long scattered hairs; thorax with dense short hairs, and a few long erect ones; abdomen pale, legs also, unmarked. Wings very faintly yellowish, unmarked, veins and stigma pale. Stigma very long and slender, rather blunt at tip; areola postica fully three times as long as broad, evenly rounded above; forks of radial sector not as long as pedicel; union of radial sector and medius much longer than base of radial sector; in anal area a long fusiform strip of minute scales or spicules; outer marginal hairs crossed as usual; in hind wings the upper branch of radial sector is strongly oblique.

Length, 3 mm.

MINDANAO, Davao Province, Mount Apo, Mainit River, altitude 6,000 feet, September 9 (*Clagg*). Type, M. C. Z. No. 21744.

Differs from *P. testaceus* Endl. in shape of stigma, shorter hairs on veins, shorter base of radial sector, and other characters.

EPIPSOCUS PROMINENS sp. nov. Plate 1, fig. 10; Plate 2, fig. 17.

Face shining black, sides of head back of antennæ pale, vertex pale, short hairs on face, longer ones on vertex; antennæ pale; eyes of male very large, not quite their short diameter apart, projecting greatly in front as well as above and laterally; the face exceptionally elongate, about twice as long as usual; thorax and abdomen brown; legs pale, tips of tibiæ darker, hind legs very long.

Wings hyaline; forewing with the stigma almost wholly brown, a small pale space at base, and a smaller one near tip; extreme tip of wing dark, veins brown, long-haired. Stigma long and slender, broadly rounded behind; forks of radial sector about as long as pedicel; areola postica elongate, over twice as long as high, highest near base, outer part sloping; crossvein from radial sector to medius longer than base of radial sector, but not longer than base of medius.

Forewing, length, 5 mm.

MINDANAO, Davao Province, Mount Apo, Mainit River, altitude 6,000 feet, September 22 (*Clagg*). Type, M. C. Z. No. 21753.

This species must be related to *E. longiceps* Endl., from Java, hardly more than one-half the size, with a face said to have a V-mark and legs more marked.

MICROPSOCUS BASALIS sp. nov. Plate 1, fig. 6.

Head brown to almost black, with scattered, moderately short, pale hairs; eyes of female about three diameters apart, of male fully twice as large and not two diameters apart; ocelli large, close together; antennæ pale yellowish brown, with moderately short hairs. Thorax brown, haired like head; abdomen brown; legs pale, unmarked.

Forewings largely brown, but with many clear spots, similar in arrangement to that of *M. erosus* Endl., but the brown more definite and not broken up by numerous small spots; base of stigma with a large clear spot (dark in *M. erosus*). Clear spots on margin of each apical cell around to just before cubitus, the one beyond stigma double; between radial sector and medius three other spots, between radius and medius (towards base) two large pale spots, one curved; in most specimens the outer dark marks appear to form a curved band. Wing somewhat broader than in *M. erosus,* but venation very similar, the intermediate median cell often much wider than figured for *M. erosus,* but variable. Hairs along margin very evenly spaced.

Length, 1.8 mm.

MINDANAO, Davao Province, Calian, June 12 (*Clagg*). Type, M. C. Z. No. 21752.

SEOPSIS TRICOLOR sp. nov. Plate 1, fig. 3.

Head brown, above almost purplish or reddish brown, clothed with very minute appressed white hair; ocelli in a moderately low triangle, the posteriors rather large, about two diameters apart and more than twice as far from eyes; antennæ very fine, with scattered long hairs; thorax also brownish, but not so dark as head; abdomen pale brown; legs pale on femora, tibiæ dark, and hind tibiæ with rather small erect bristles.

Forewings dark, largely with dark scales, a broad oblique stripe of yellowish to golden scales, starting from near hind margin at end of basal third, and extending out to near tip of wing where there is a circular patch of jet black hair; the lower border of the yellow stripe edged with snow white, white scales in front and behind the apical black spot; just before the black spot two divergent lines of white scales across the black from the yellow stripe to costa, and about at middle a patch or two lines of white from yellow stripe to margin. Hind wings faintly

infuscate, rather darker near tip. Fringes short and mostly dark, but two white patches near tip of forewing.

Length, 3.5 mm.

MINDANAO, Davao Province, Baroring River, 7,000 feet; Galog and Mainit Rivers, 6,000 feet; Tia Ridge, 6,500 feet; all on Mount Apo, September to November; Lawa, May 5 (*Clagg*). Type, M. C. Z. No. 21755.

SEOPSIS LUZONICA sp. nov. Plate 1, fig. 5.

Head dull yellowish, or brown, with a pale band across, interrupted by ocelli, and with two dark marks each side on vertex, clothed with minute appressed white hair; ocelli in a moderately low triangle, posteriors about twice as far from eyes as from each other; antennæ pale, very short and fine, with scattered long hairs; thorax brown, with fine white hairs; abdomen brown above, pale beneath; legs pale, tibiæ with some fine bristles.

Forewings brown, clothed with tawny to golden scales, and with many snow white ones intermingled, the white mostly on posterior and outer part without definite pattern, a large spot of tawny scales at tip of wing. Hind wings hyaline, apical third infuscate, veins brown. Fringes of both pairs rather short, mostly of dark hair.

Length, 2.2 mm.

LUZON, Laguna Province, Mount Maquiling (*Baker*). Type, M. C. Z. No. 21754.

PERLIDÆ

Key to the Philippine species of Neoperla.

1. Wings black ..... *atripennis.*
   Wings yellowish or yellowish brown ..... 2.
2. Forewings with a clear space near middle; ocelli fully one diameter apart, scars much nearer to eyes than to ocelli ..... *hermosa.*
   Forewings without a clearer space near middle ..... 3.
3. Cubital fork arising near first cubital crossvein in a broad angle, sometimes beyond the crossvein; smaller species ..... 4.
   Cubital fork arising much before the first cubital crossvein in a very acute angle; usually larger species ..... 7.
4. Ocelli but little, if any, more than one diameter apart and twice as far from the lateral scars ..... 5.
   Ocelli farther apart, and not twice as far from the lateral scars ..... 6.
5. Wings and veins wholly pale yellowish ..... *clarissa.*
   Wings and veins brownish ..... *consimilis.*
6. Wings hyaline, veins yellow ..... *bakeri.*
   Wings fumose, veins brownish ..... *claggi.*
7. Lateral carina of face usually not extending back of inner angle of eye; radial crossvein nearly straight across ..... 8.

Lateral carina of face usually extending back of inner angle of eye; radial crossvein very plainly oblique; rarely crossveins among radial branches ..... 11.

8. Antennæ dark; tibia slightly darker than femur; ventral plate somewhat angulate behind ..... 9.
   Antennæ pale; tibia not darker than femur ..... 10.
9. Ocelli large, larger than lateral scars ..... *viscayana.*
   Ocelli not larger than lateral scars; dark cloud on clypeus; ocelli rather farther apart than usual; often one or more crossveins among the branches of radial sector ..... *recta.*
10. Pronotum broadly margined with pale; lateral carina of face extended back ..... *pallescens.*
    Pronotum wholly brownish ..... *pallicornis.*
11. Antennæ darkened beyond first joint; crossveins not darkened ..... *obliqua.*
    Antennæ not darkened beyond basal joint ..... 12.
12. Eyes short, round; head not darkened; radial crossvein only slightly oblique; lateral border of pronotum broadly pale yellow ..... *pallescens.*
    Eyes elongate, almost pointed behind; head darkened; lateral border of pronotum not broadly pale yellow ..... *apoana.*

Neoperla incerta Klap., 1921, one female from Mindanao; the author says ocelli as close to eyes as to each other. This description fits none I have seen, but in *N. recta* the ocelli approach this condition; the ventral plate is shown angulate behind, so *N. incerta* is doubtless a synonym of *N. recta.*

Folga luzonica Navas, 1918, is also the same as *N. recta.*

Neoperla pastellsi Navas, 1925, is probably *N. obliqua,* judging from Navas's figure of the ocelli and his description.

NEOPERLA PALLESCENS sp. nov.

Face pale brownish; basal joint of antennæ also brown, beyond pale; palpi pale; no distinct spot around ocelli; pronotum broadly pale yellow on the sides, more than one-half of middle brownish; thorax and abdomen yellowish; legs and setæ also pale yellow; wings pale yellowish, veins yellow. Eyes short and nearly circular; ocelli moderately large, about one and one-half diameters apart, fully twice as far from the eyes; lateral scars about as large as ocelli, and scarcely nearer to eyes than to ocelli; lateral face ridges continued back of eyes. Pronotum only a little broader in front than long, anterior angles not prominent, sides rounded and tapering a little behind; ventral plate of female evenly and slightly convex.

Forewings with cubital fork arising at an acute angle long before first cubital crossvein, but there is an oblique medial crossvein (hardly complete) just before it; all costal crossveins thickened, two beyond end of subcosta, radial crossvein scarcely oblique, radial sector with two branches beyond crossvein; sec-

ond anal vein parallel to first, third anal not sinuous; seven or eight medial crossveins, five or six cubital crossveins.

Hind wings with about six cubital crossveins, radial sector with two branches beyond crossvein.

Expanse, 30 mm.

MINDANAO, Kolambugan (*Baker*). Type, M. C. Z. No. 22101.

NEOPERLA APOANA sp. nov.

Head more or less embrowned, without definite marks; palpi brownish; first joint of antennæ usually brown, beyond paler; legs pale, tibia no darker than femur, latter sometimes darkened near tip; pronotum brownish, often paler on sides; sternum and abdomen pale, as also the setæ, meso- and metanotum usually showing a pale median stripe. Wings scarcely infuscate, veins pale yellowish brown, some crossveins often faintly margined with brown, costal veins paler; in hind wings all veins pale.

On head the lateral carina extending backward beyond angle of eye; ocelli of moderate size, hardly two diameters apart, sometimes a little more, twice as far from eyes; lateral scars elliptical, slightly oblique, usually as near or nearer to eye than to ocellus; pronotum usually as wide as head, anterior corners often angulate and prominent, behind narrowed, but not as much as in *N. recta,* anterior margin moderately convex, rugose as usual; ventral plate straight across; last dorsal segment evenly convex.

Forewings with cubital fork arising at an acute angle long before first crossvein; two to five crossveins beyond end of subcosta, numerous costals, usually all of them thickened, about seven to nine median crossveins and five to six cubitals, radial sector 3- or 4-branched, radial crossvein plainly oblique.

Hind wings with five to eight cubital crossveins, radial sector 3- or 4-branched.

Expanse, 37 to 45 mm.

MINDANAO, Davao Province, Mount Apo, Galog River, altitude 6,000 feet, October 18 to 23, many specimens (*Clagg*). Type, M. C. Z. No. 22102.

Separated from *N. obliqua* by paler antennæ, darker venation, slightly closer ocelli, and larger size.

NEOPERLA CLAGGI sp. nov. Plate 2, fig. 21.

Extremely similar in structure and size to *N. bakeri,* differing in darker body and legs, and wings fumose throughout, veins brownish; male with long anterior process of clasper heavier than in *N. bakeri* and the lower process shorter and blunter; ventral plate of female straight across.

Ocelli two diameters or a little more apart, and fully twice as far from eyes; lateral scars a little farther from ocelli than the latter are apart, and plainly nearer to eyes; pronotum almost as wide as head, corners and sides rounded. Forewing with one or two crossveins beyond subcosta; two or three costal crossveins before end fine (not thickened as others), radial sector usually 2-branched beyond radial crossvein.

MINDANAO, Davao Province, Mainit River, altitude 6,500 feet, October 27, and Galog River, 6,000 feet, October 18, both on Mount Apo (*Clagg*). BASILAN (*Baker*), a slightly smaller specimen. Type, M. C. Z. No. 22103.

NEOPERLA PALLICORNIS sp. nov.

Face yellowish, faintly brownish in middle, antennæ wholly pale; pronotum pale brownish; thorax and abdomen mostly yellowish, setæ also, the tips but little darker; wings faintly yellowish, veins yellow. Lateral carinæ of face not extending back; ocelli one and one-half diameters apart, and fully twice as far from eyes, eyes rather elongate, somewhat pointed in front and behind; lateral scars moderately large, fully as close to ocelli as to eyes.

Pronotum much broader in front than long, anterior angles sharp, prominent, sides much sloping behind; margin of ventral plate straight. Forewings with cubital fork arising at acute angle much before crossvein; costals all thickened, two crossveins beyond subcostal; radial crossvein scarcely oblique; radial sector with one or two branches beyond crossvein; second anal almost parallel to first, third anal slightly sinuate; about six crossveins in both median and cubital areas. In hind wings four or five cubital crossveins.

Expanse, 24 mm.

LUZON, Laguna Province, Mount Maquiling, 2 females (*Baker*). Type, M. C. Z. No. 22104.

A male, which probably belongs with these females, differs in having the head and basal joint of antennæ somewhat darkened, and the veins are faintly brownish; the genitalia have the apical process stouter towards base than in *N. recta*, and there is no tubercle or process in front of it, only a small scabrous area.

HEMEROBIIDÆ

Key to the Philippine species of Archæomicromus.

1. Four or five radial sectors; outer gradates irregular, not parallel to inner series ..... *igorotus.*
   More radial sectors; outer gradates in a more even row..... 2.

2. Five to six radial sectors; wings scarcely marked; tibiæ not banded, first median cell usually shorter than second, hardly if any longer than its pedicel to the basal crossvein ..... *pusillus.*
   Seven to ten radial sectors; wings more marked with dark; tibiæ often banded with dark ..... 3.
3. Front and midtibiæ bifasciate, hind tibiæ with three bands behind, also marks on femora; seven radial sectors; first median cell longer than second; three dark spots along basal cubitus ..... *pictipes.*
   Hind tibiæ without bands ..... 4.
4. First median cell plainly shorter than second; eight to nine radial sectors; veins between gradate series pale, almost unmarked, front tibiæ bifasciate; pronotum with two dark spots ..... *placidus.*
   First median cell fully as long or longer than second, and very much longer than its pedicel ..... 5.
5. Seven to eight radial sectors; upper three of inner gradates not much separated from others; veins between gradate series much marked, as elsewhere; top of head and pronotum black; only small spot before stigma ..... *nigrifrons.*
   Ten radial sectors; upper three of inner gradates widely separated from others; upper end of outer row much incurved; veins between gradate series scarcely marked; both gradate series heavily bordered; head and pronotum pale; large spot before stigma ..... *gratus.*

MICROMUS (ARCHÆOMICROMUS) PICTIPES Banks.

I know only the type from Baguio, Benguet Subprovince, Luzon (*Baker*).

MICROMUS (ARCHÆOMICROMUS) IGOROTUS Banks.

LUZON, Laguna Province, Mount Maquiling and Los Baños: Mountain Province, Baguio (*Baker*).

MICROMUS (ARCHÆOMICROMUS) PUSILLUS Gerst.

From many localities in Luzon. *Micromus philippinus* Navas, 1926, is the same species.

MICROMUS (ARCHÆOMICROMUS) GRATUS sp. nov.

Tawny or faintly rufous; vertex dark each side by the eye, basal joint of antenna dark brown, beyond brownish; pronotum with a dark spot on each side, lateral lobes of mesonotum dark; abdomen brown; legs pale, front and midtibiæ faintly bifasciate with brown. Forewings with anal area narrowly dark brown, and a dark brown spot over connection of median and cubitus with an extension towards radius; inner and outer gradates dark brown and mostly bordered; several long streaks on radius; a large brown spot before stigma, a small one at end and another between them; radial sectors and branches of medius but little marked, but not yellowish, scarcely at all marked between the gradate series.

Hind wings with outer gradates, cubitus and its branches, and some veins near upper base dark, stigma dark.

Wings moderately narrow; in forewing most of the gradates in fairly even series, but the upper three of inner row widely separated from the others, the upper four of outer row turn that row inward; ten radial sectors; medius forks long before second cubital crossvein; first median cell longer than second, and very much longer than its pedicel; outer cubitus connected to medius by a distinct crossvein; basal cubital cell much widened before first cubital crossvein.

Forewing, length, 10 mm; width, 3.7.

MINDANAO, Davao Province, Mount Apo, Tia Ridge, altitude 6,500 feet (*Clagg*). Type, M. C. Z. No. 20207.

MICROMUS (ARCHÆOMICROMUS) PLACIDUS sp. nov.

Yellowish; face from between antennæ down on clypeus darker; basal joint of antennæ scarcely dark; pronotum with a large dark spot on each side, dark spots or stripes over lateral lobes of mesonotum; front and midtibiæ with two dark bands.

Forewings with several brown bands occupying most of anal area, a dark brown spot over connection of medius and cubitus, and both series of gradates dark brown, the inner row bordered; costals with a few dark spots, larger one before and after stigma, outer forks more or less dark, including the branches of medius, radial sectors before inner gradates also partly dark but almost wholly pale yellowish between the two series of gradates.

Hind wings with outer gradates, cubitus, and some veins near base dark.

Wings moderately narrow; eight or nine radial sectors, gradates (9 and 11) in nearly even almost parallel series, in inner row the upper two well separated, the medius forks much before second cubital crossvein, cubitus forked near this crossvein, outer fork connected to medius by a short crossvein; first median cell much shorter than second, but nearly as long as its pedicel.

Forewing, length, 6.8 mm; width, 2.5.

SAMAR (*Baker*). Type, M. C. Z. No. 20205.

MICROMUS (ARCHÆOMICROMUS) NIGRIFRONS sp. nov.

Face brown, a yellowish band below antennæ, vertex and pronotum black; basal joint of antennæ black, beyond brown; abdomen dark; legs yellowish, front femora dark, none of tibiæ plainly marked.

Forewing with anal region almost wholly dark brown and a prominent dark brown spot over connection of medius and cubitus, gradates dark and slightly bordered with brown, radial sectors and branches of medius mostly dark, with occasional pale streaks or spots, costals partly dark, small spots each side of stigma.

Hind wings with outer gradates dark brown, veins beyond and behind them more or less dark, venation before them mostly pale yellowish.

Forewings moderately narrow; in one wing cubitus connected to medius by a short crossvein, in the other united with it for a short distance, first median cell as long as second and very much longer than its pedicel; seven to eight radial sectors, eight inner gradates, ten outer, in nearly parallel series, the upper ones of the inner row not especially separated, outer row a little incurved at upper end; the medius forks long before second cubital crossvein.

Forewing, length, 7 mm; width, 2.8.

MINDANAO, Davao Province, Mount Apo, Galog River, altitude 6,000 feet (*Clagg*). Type, M. C. Z. No. 20206.

MICROMUS (MICROMUS) ANGUSTIOR Weele.

Common in the Philippines, especially in Luzon. *Nenus luzonica* Navas is the same species; *N. novitus* Navas, from Japan and Formosa, is very similar, but I think distinct. *Micromus linearis* Hagen, from Ceylon, also goes in this subgenus. The type of *Micromus* is *variegatus,* and in that the cubitus in hind wing runs into the medius, just as in the species of *Nenus.*

Key to the Philippine species of Hemerobius.

1. First median cell no longer than second, inner series of gradates incomplete and uneven; last radial sector with four branches before outer gradates ..... *tagalicus.*
   First median cell much longer than second, sometimes twice as long; last radial sector with three branches..... 2.
2. Second subradial space much longer than first, space between the two gradate series not much narrower than the space beyond outer gradates ..... *claggi.*
   Second subradial space not noticeably longer than first; space between the two gradate series narrower than the space beyond the outer gradates ..... 3.
3. Male genitalia with lower process slender, projecting downward to lower edge of abdomen. Veins more dotted..... *rizali.*
   Male genitalia with lower process projecting outward, from the side small and knoblike, inwardly pointed; outer space of wing unusually wide; veins not or scarcely dotted..... *vagans.*

HEMEROBIUS CLAGGI sp. nov.

Yellowish; a dark brown mark under each eye; pronotum broadly dark on each side, mesonotal lobes scarcely darkened; legs pale, unmarked.

Forewings with most veins interruptedly brown and pale, sometimes in streaks, often in dots; gradates and a few basal crossveins dark brown, margin with some pale yellowish spots, otherwise brown; stigmal area slightly darkened; hyaline line in costal area very distinct.

Hind wings with veins not dotted, but either pale brown (mostly near base) or yellowish, most of the gradates brown, stigma brownish.

Forewings with three radial sectors, the last one with three forks (not counting tiny apicals); second subradial cell much longer than first; gradates subparallel, intermediate area about as broad as apical area; six in inner gradates, seven in outer row; crossvein from medius to radius hardly its length before first radial sector; first median cell nearly twice as long as second.

Forewing, length, 7.5 mm; width, 3.

MINDANAO, Davao Province, Mount Apo, Kidapayan Trail, altitude 7,000 to 9,000 feet, September 18 to 20 (*Clagg*). Type, M. C. Z. No. 20209.

HEMEROBIUS VAGANS sp. nov. Plate 2, fig. 24.

Yellowish; a brown stripe below each eye; pronotum broadly black on sides; legs unmarked. Forewings with veins marked with dark brown, mostly in streaks; gradates wholly dark brown, an irregular dark brown spot over the connection from cubitus to medius; stigma not strongly marked.

Hind wings with veins mostly pale brownish, outer gradates and cubitus darker. Forewing with three radial sectors, the last forked three times; first and second subradial spaces subequal; gradates (four and six) nearly parallel, space between the two rows much narrower than the apical area which is unusually broad; first median cell much longer than second. Male appendages not very prominent, the curved tip tapering to a point inwardly, before it a smaller process or tooth, seen from the side the tip somewhat knob-shaped.

Length, forewing, 7 mm; width, 2.8.

MINDANAO, Davao Province, Mount Apo, Seliban River, altitude 7,000 feet, September 11 (*Clagg*). Type, M. C. Z. No. 20208.

HEMEROBIUS RIZALI Banks. Plate 2, fig. 13.

LUZON, Benguet Subprovince, Baguio (*Baker*).

Hemerobius inversus Navas, 1927, is also from Baguio, and the description agrees except that Navas gives more gradates in inner than in outer series, a variable point; for his 5-branched last radial sector, he probably counts the two small ones near tip.

HEMEROBIUS TAGALICUS Banks.

LUZON, Nueva Vizcaya Province, Imugan (*Baker*).

Hemerobius baguiensis Navas, 1923, also from Baguio, is said to have a dark head, very long antennæ, and three radial crossveins; it would seem to be very different and perhaps of another genus.

Navas also describes *Megalomus exillatus* from the Philippines.

CHRYSOPIDÆ

The Chrysopidæ obtained by Clagg in Mindanao have induced me to go over all our Philippine species, and I have prepared synoptic tables of the two principal genera, *Ankylopteryx* and *Chrysopa*.

ANKYLOPTERYX BRAUERI sp. nov.

Whitish or pale yellowish; a black spot each side under eye, one each side on the clypeus, last joint of the maxillary palpi marked with dark; a black spot at middle of front and midtibiæ, the tips of the tarsi black, no dark elsewhere on the body.

Wings with venation largely pale; in forewings the outer ends of first few costal crossveins dark; origin of radial sector, several of radial crossveins toward stigma, and some branches of anal vein dark. Gradates, especially inner row, dark, inner row often faintly dark-bordered, a distinct brown cloud over the first two; in hinder and outer part of wing a dozen or more faint brown clouds, in outer part of wing these often in the bases of the marginal forks. Hind wings with similar faint clouds, but hardly as many, elsewhere venation pale, except second cubital crossvein dark.

The wings, in shape and venation, are generally similar to those of *A. doleschali*, and the divisory cell is as small as in that species. There are about six to eight gradates in each series, the outer series nearly parallel to the outer margin, the gradates of the inner series often rather widely separated from each other, the first two close together and transverse (as in *A. trimaculata* and *A. nonelli*).

Pronotum plainly longer than broad, narrowed in front.

Length, 10 mm; forewing, length, 13.5 to 14.5; width, 6.

MINDANAO, Davao Province, Batraeyon, and Galog, Seliban, and Sibulan Rivers, all on Mount Apo, altitude 6,000 to 8,000 feet, September to early October (*Clagg*). Type, M. C. Z. No. 20164.

ANKYLOPTERIX CLAGGI sp. nov.

Pale yellowish, face with the usual black spots below each eye and on sides of clypeus; also three black dots, one below base of each antenna, and one between the two; no other dark spots on head, none on tibiæ; tips of tarsi pale.

Pronotum nearly twice as broad as long, unspotted, mesonotum with faint dark marks in front and at base of forewings. Venation greenish; forewing with costa at base and two or three of the basal costal crossveins black, origin of radial sector and the first crossvein behind it black, several radial crossveins before stigma, both series of gradates dark, inner series darker than outer; a branch from cubitus to hind margin of wing near middle black and broadly black-margined; very faint clouds of brown on some of the marginal forks, a few crossveins near base of wing dark, including hind part of base of second cubital cell, a few cubital crossveins also faintly margined; stigma green. Hind wings with green veins and stigma, a few faint clouds near hind margin.

Forewings with costal area at base less broad than usual (but much more than in *Chrysopa*) ; divisory cell triangular, of fair size; about eight gradates in each series, far apart, outer row parallel to outer margin, inner row directed towards stigma; radial sector about as curved as usual in the genus.

Length, 9 mm; forewing, length, 13; width, 5.

MINDANAO, Davao Province, Mount Mayo, altitude 4,000 to 5,000 feet, January (*Clagg*). Type, M. C. Z. No. 20165.

By the narrower costal area this species approaches *Chrysopa* and particularly *Ch. nigribasis* Bks., and the latter species may be removed to *Ankylopteryx*. However, in *A. claggi* the face marks and the much curved radial sector are characteristic of *Ankylopteryx*.

Key to the Philippine species of Ankylopteryx.

1. No divisory veinlet in third cubital cell ..... *anomala*.
   This veinlet present, setting off a small cell in upper basal part of third cubital cell ..... 2.

2. Front and midtibiæ with a median dark spot ..... 10.
   Front and midtibiæ unspotted ..... 3.
3. Black across base of mesothorax ..... 4.
   Not so marked ..... 5.
4. Three large black spots in each wing, costal area as wide as usual at base, average size ..... *nonelli.*
   No large dark spots on wings, costal area not near as wide as usual, small size ..... *Chrysopa nigribasis.*
5. Wings unmarked, veins wholly pale ..... *perpallida.*
   Wings more or less marked ..... 6.
6. Forewings with some of the discal veins broadly margined with yellowish brown ..... 7.
   Forewings without such yellowish marks ..... 8.
7. Last crossvein between radial sector and medius giving off two branches, radial sector extremely sinuous, many brown clouds ..... *obliqua.*
   That crossvein not giving off two branches, radial sector less sinuous, fewer brown clouds ..... *nervosa.*
8. Only outer gradates black, radial sector strongly sinuous ..... 9.
   All gradates black, and also a broadly margined branch of cubitus to hind margin; three dark dots on face ..... *claggi.*
9. No dark spot over base of inner gradates ..... *polygramma.*
   A dark spot over base of inner gradates, stigma distinct, divisory cell usually 4-sided ..... Ceylon species.
10. No dark spot over base of inner gradates, outer gradates only black, radial sector very sinuous, stigma indistinct ..... *polygramma.*
    A dark spot over lower base of inner gradates, stigma and a spot near end of anal vein usually also present ..... 11.
11. Divisory cell very small, 2- or 3-sided ..... 12.
    Divisory cell normal, often 4-sided ..... 13.
12. Stigma usually marked, pronotum with a spot each side ..... *doleschali.*
    Stigma not marked, pronotum without spots, outer gradates dark. *braueri.*
13. Thorax unmarked, stigma marked ..... *punctata.*
    Thorax with some dark spots ..... 14.
14. Mouth pale, smaller species, stigma not marked ..... *borneensis.*
    Mouth dark, stigma usually and a spot near end of anals dark. *octopunctata* (*trimaculata*), *candida* (*sigillaris*).

CHRYSOPA EXCELSIOR sp. nov.

Head rather dark, discolored, but without black marks; antennæ, palpi, and legs pale; thorax pale yellowish, pronotum with a black spot each side near middle of extreme lateral margin. Forewings with longitudinal veins pale, many crossveins dark, at least in part; costals for one-half way out, most of radials, origin of radial sector, medials, both series of gradates, cubitals, and anals marked with dark; stigma yellowish; in hind wings venation pale.

Forewings with costal area as broad as radial area; postcubital area about twice as broad as cubital area; divisory veinlet

ending much beyond crossvein; about seven crossveins in each gradate series, inner series irregular, the first towards base, third, fourth, and fifth close together and more transverse than first and second; outer series even, about as near to inner row as to outer margin, to which it is parallel.

Pronotum nearly as long as broad, a little narrowed towards front.

Length, 10 mm; forewings, length, 15; width, 5.

MINDANAO, Davao Province, Mount Apo, Seliban River, altitude 7,000 feet, September 13 (*Clagg*). Type, M. C. Z. No. 20166.

CHRYSOPA NOTULATA sp. nov.

Head pale, unmarked, likewise palpi, antennæ, and legs; thorax yellowish, pronotum with two small dark submedian spots in the front part, and faint short lines in the hind part. Forewings with longitudinal veins greenish, many costals on basal part black, but not the first two or three, several radials dark in middle, some branches of cubitus and a few in anal area dark; inner gradates dark, outer series pale, origin of radial sector and bases of branches of radial sector pale, stigma pale greenish.

Hind wings with greenish venation; forewings with costal area as broad as radial area; divisory veinlet ends much beyond crossvein; second crossvein from anal to cubitus scarcely oblique; about seven veinlets in each gradate series, first and second more basad, others in even row, about parallel to outer row, but nearer to radial sector than to outer row, outer row thus much nearer to outer margin than to inner gradates; postcubital area only about one-half wider than cubital area.

Pronotum much broader than long, scarcely narrowed in front.

Length, 11 mm; forewing, length, 15; width, 5.

MINDANAO, Davao Province, La Lun Mountains, May 3 (*Clagg*). Type, M. C. Z. No. 20167.

CHRYSOPA DEROTA sp. nov. Plate 2, fig. 16.

Head pale, unmarked; palpi, antennæ, and legs pale, thorax also, pronotum with a dark spot each side towards, but not on, the lateral margin.

Forewings with longitudinal veins greenish, most of costal crossveins, nearly all of radials, base of radial sector, bases of branches of radial sector, medials, most of cubitals, and anals in part dark; both series of gradates dark; stigma yellowish green; hind wings with pale venation.

Forewings with costal area plainly not as broad as radial area; divisory veinlet ending much beyond the crossvein; seven or eight veinlets in each gradate series, fairly evenly placed, the rows subparallel and also to the outer margin, inner row about as near to the outer as to radial sector, outer row as near to the inner as to the outer margin; postcubital area not nearly twice as broad as the cubital area.

Pronotum much broader than long, scarcely narrowed in front.

Length, 9 mm; forewing, length, 12; width, 4.5.

MINDANAO, Davao Province, Mount Apo, Mainit River, altitude 6,500 feet, October 22 (*Clagg*). Type, M. C. Z. No. 20168.

A specimen, not fully colored, from Sandakan, Borneo, may belong to this species.

CHRYSOPA MINDANENSIS sp. nov. Plate 1, fig. 11.

Pale yellowish; face, palpi, antennæ, and head unmarked, except two very small black spots on front of the vertex near middle; thorax green on sides, broadly yellow through the middle, pronotum faintly reddish on sides; abdomen green on sides, a pale median stripe above; legs wholly pale.

Wings with longitudinal veins green; forewings with gradates and many crossveins dark, several costals towards base at least in part dark, the first few radials at least partly, several cubitals, divisory veinlet, origin of radial sector, and some anal crossveins dark; stigma greenish; hind wings with green veins, no marks, except inner gradates somewhat darkened. Forewings moderately long, cubitus swollen towards base, divisory ends just beyond crossvein; eight to ten in each gradate series, outer row subparallel to outer margin, and very much nearer to margin than to inner series, inner row also subparallel to outer margin, about as near radial sector as to outer row.

Pronotum much broader than long, a little narrowed in front.

Length, 9 mm; forewings, length, 12.5; width, 4.5.

MINDANAO, Davao Province, Mount Mayo, altitude 4,000 to 5,000 feet, January 26 (*Clagg*). Type, M. C. Z. No. 20169.

CHRYSOPA APOANA sp. nov. Plate 2, figs. 22 and 23.

Head, antennæ, and palpi pale, unmarked; pronotum pale, with a large black spot each side behind, no marks on rest of thorax; legs pale. Wings with longitudinal veins mostly pale, but radial sector for a short distance and median by the second cubital cell black; costal crossveins for nearly halfway out more or less black, radial crossveins at first black, then black

only in the middle, a few medial and a few cubital crossveins towards base black, outer gradates black, inner pale; stigma greenish, a few anal crossveins also dark; hind wings with wholly pale greenish venation.

Pronotum broader than long, narrowed towards front. Wings moderately long, many of the crossveins a little more oblique than usual, radial crossveins beyond first five or six oblique and sinuous, the last few short ones straight across (like those in *C. obliquata*); hairs on veins not as long as in *C. obliquata.* About eight veinlets in each gradate series, veinlets often shorter than the distance apart, outer series nearly parallel to outer margin, inner row about as near to outer row as to radial sector and nearly parallel to outer row, divisory veinlet ending much beyond crossvein.

Length, 10 mm; forewing, length, 15; width, 5.

MINDANAO, Davao Province, Mount Apo, Mainit River, altitude 6,000 feet, September 22 (*Clagg*). Type, M. C. Z. No. 20170.

This species (with my *Ch. obliquata*) will go in the Navasian genus *Scoliochrysa,* because of the sinuous veins in the radial area; the character varies so gradually to the straight veins of typical *Chrysopa* that the genus is but a synonym of *Chrysopa.*

Key to the Philippine species of Chrysopa.

1. Antennæ black or almost black ..... 2.
   Antennæ pale ..... 4.
2. Forewing more than 15 mm, head reddish, hairs on veins very short. *ruficeps.*
   Forewing less than 15 mm ..... 3.
3. Basal joint of antennæ with a black mark ..... *flaveola.*
   Basal joint of antennæ unmarked ..... *eurycista.*
4. Apical cells of forewing containing golden iridescent spots ..... *splendida.*
   No such golden spots ..... 5.
5. Stigma very plainly dark at one or both ends, dark marks on head, and on thorax above and below base of front wing ..... 6.
   Stigma not plainly dark at either end, no such marks on thorax ..... 9.
6. Tibiæ with black spots near base and at middle, pronotum margined; usually but three or four veinlets in each gradate series ..... *bakeri.*
   Tibiæ without black marks, a black spot between antennæ, usually five veinlets in each gradate series ..... 7.
7. Costals largely black, as also most of radials, and bases of the branches of radial sector ..... *rizali.*
   Costals scarcely, if at all, dark ..... 8.
8. Two spots on vertex, and a large spot each side on pronotum towards front ..... *valdezi.*
   No spots on vertex or pronotum, at most very small faint ones. *caliptera.*

9. Second joint of antennæ dark ..... 10.
   Second joint of antennæ pale ..... 11.
10. Face mostly dark with red or brown, with red spots below antennæ. *atrioris.*
    Face pale ..... *azygota.*
11. Thorax with black across base of mesothorax, costal area broad at base ..... *nigribasis.*
    Not so ..... 12.
12. At least one row of gradates dark, as also some other crossveins ..... 13.
    Gradates pale, as is rest of venation ..... 21.
13. Radial crossveins near stigma very oblique and sinuous ..... 14.
    Radial crossveins scarcely oblique and not sinuous ..... 15.
14. A large black spot on each side of pronotum ..... *apoana.*
    No such spots on pronotum ..... *obliquata.*
15. A dark mark on each side of face from eye to mouth ..... 16.
    No dark mark on face, costals towards base partly black ..... 17.
16. Costal pale, only two gradate series ..... *ilota.*
    Costals and radials largely dark, a partial third (intermediate) row of gradates ..... *winkleri.*
17. A distinct black spot near each lateral margin of pronotum ..... 18.
    No such black spots ..... 19.
18. Inner gradates irregular, third, fourth, and fifth close together; costal area as broad as radial area ..... *excelsior.*
    Inner gradates in fairly even row; costal area not so broad as radial area ..... *derota.*
19. Basal joint of antennæ reddish on outer side, the red showing also between antennæ and eyes, inner gradate series extended basally. *alticola.*
    Basal joint of antennæ not reddish, no red on head ..... 20.
20. Outer gradates pale, thorax with a broad yellow median stripe. *mindanensis.*
    Outer gradates dark, pronotum with a pair of small submedian dark spots ..... *notulata.*
21. Postcubital area scarcely, if at all, broader than cubital area, pronotum broad, inner gradates reduced to three or four ..... *isolata.*
    Postcubital area plainly broader than the cubital area ..... 22.
22. Pronotum twice as broad as long, and with a median yellow stripe. *maquilingi.*
    Pronotum not twice so broad as long ..... 23.
23. Inner gradate series with upper veinlet fully twice as near to radial sector as to outer gradate row ..... *tagalica.*
    Inner gradate series with upper veinlet not nearly twice so close to radial sector as to outer gradate row ..... *morota.*

Chrysopa procubitalis Navas is, I think, *C. ruficeps* McLachlan.

Chrysopa faceta Navas is *C. splendida* van der Weele.

Chrysopa buruana E. Petersen is close to and probably the same as, *C. bakeri;* the type of *C. bakeri* has the outer margin very dark, but one from Luzon is more like Petersen's figure; a specimen from Basilan lacks the spots on the vertex.

Chrysopa boettcheri E. Petersen is surely *C. bakeri.*

Chrysopa herasi Navas, and I think *C. unicolor* Navas also, are the same as *C. morota* Bks.

Chrysopa maquilingi is a new name for *C. inconspicua* Navas, 1926; Navas had used the same name for a West African species in 1914.

Chrysopa formosana E. Petersen is, according to a paratype sent me by M. E. Petersen, different from *tagalica,* having the inner gradates much nearer to the outer ones, and differing in other respects. However, specimens later sent me as *C. formosana* from the Philippines are *C. tagalica* Bks.

Chrysopa nigribasis Bks. approaches *Ankylopteryx,* and I have inserted it in both tables. The costal area is broader, and the radial sector more curved than usual in *Chrysopa,* but not as much so as in normal *Ankylopteryx;* however, the new *A. claggi* is more like *C. nigribasis* in these respects.

Chrysopa winkleri Navas is the basis of his genus *Bornia,* based on the extra series of gradates; the number of veinlets in this extra series is variable, probably never complete, and other species of *Chrysopa* sometimes show one or two extra veinlets; on that character the genus is invalid.

Chrysopa obliquata and *C. apoana* would go in the Navasian genus *Scoliochrysa,* based on the oblique and sinuous radial crossveins in a Papuan species. The amount of obliquity is variable and in several other species plainly a little oblique, so that that generic name must fall.

Chrysopa splendida Weele is the basis of *Glenochrysa,* but this species is plainly related to *C. rizali* and *C. bakeri* (*buruana*).

If these generic names are to be valid, others should be given for the section *nigribasis,* for the section of *ruficeps, flaveola,* and others, for the section of *morota, tagalica,* and others, as well as for numerous other sections in other countries. The Navasian genus *Cintameva* has already been shown to be typical *Chrysopa,* and the genus *Chrysocera* Weele is based on a character only in male appendages and of variable development, so also falls to *Chrysopa.*

OSMYLIDÆ

HELIOSMYLUS MONTICOLUS sp. nov.

Face yellowish, basal joints of antennæ also, beyond brown, vertex brownish, pronotum also brown, darker on sides, rest of thorax and abdomen brown, latter dark brown above; legs pale, faint spots on tibiæ.

Forewings with largely brown veins, many bordered, five or six brown streaks between subcosta and radius, the veins adjoining brown; a large brown spot each side of the pale yellowish stigma; outer gradates heavily brown, a spot over and near next to last median crossvein, and another before that. Hind wings with spots, stigma, outer gradates, and some along median before it brown, other veins pale brownish, the outer border with some pale places.

Forewing with about fifteen or sixteen radials, about seventeen cubital crossveins, and thirteen branches to radial sector; veins densely haired as in *H. fraternus*.

Forewing, length, 21 mm; width, 7.

MINDANAO, Davao Province, Seliban River, altitude 7,000 feet, September 3; Galog River, altitude 6,000 feet, November 4; Baroring River, altitude 7,000 feet, November 9; all on Mount Apo; La Lun Mountains, July 4 (*Clagg*). Type, M. C. Z. No. 20204.

Paler and much less heavily marked than *H. fraternus* Bks., from Kinabalu; the latter species has but thirteen radial crossveins.

Key to the Philippine species of Spilosmylus.

1. Only two places with dark lines on subcosta and radius..... 2.
   Four or more places with dark lines on subcosta and radius..... 3.
2. An amber streak reaching towards wing tip somewhat behind radial sector; apical costal area with two or three oblique brown marks; bulla very large; venation of forewing almost wholly pale; hairs on costal crossveins pale, but little longer than width of cell; fifteen to seventeen radial crossveins before stigma..... *formosus.*
   No such amber or brown streaks; many crossveins dark brown; pronotum with four brown spots, as also on mesonotum; some erect hairs on costal crossveins are black and equal the width of two cells; only twelve radial crossveins ..... *proximus.*
3. Forewing with amber or golden bands, two across wing and one or two longitudinal towards tip; fourteen radial crossveins before stigma. *inquinatus.*
   Forewing without such amber marks; usually twelve radial crossveins before stigma ..... 4.
4. Four pairs of black lines on subcosta and radius, and a narrow black line between; marginal forks practically wholly pale; many crossveins wholly dark, no veins dotted with dark, bulla small; first anal crossvein scarcely oblique ..... *alticolus.*
   Five or six pairs of black lines on subcosta and radius, longitudinal or other veins marked with brown or dotted; first anal crossvein plainly oblique ..... 5.
5. No interlineal lines between subcosta and radius; first crossvein from median to radial sector ends on first branch of radial sector.. *modestus.*

Interlineal lines between subcosta and radius, sometimes interrupted with snow white; first crossvein from median to radial sector at or before origin of first branch of sector..... *apoanus.*

SPILOSMYLUS INQUINATUS McLachl.

Specimens from Luzon and Samar. The amber marks on the wings are characteristic; *S. lineatus* Navas, 1912, and *S. nephelius* Navas, 1926, agree in their descriptions with *S. inquinatus.*

SPILOSMYLUS FORMOSUS Banks.

Only the type, from Surigao, Mindanao.

SPILOSMYLUS MODESTUS Gerst.

One from "Philippines, Thorey," Hagen collection, others from Sandakan, northern Borneo. Extremely close to *S. tuberculatus* Walker; I find about the only difference is that in *S. modestus* there are more crossveins in the middle of the wing that are wholly white than in the two *tuberculatus* that I have from the Malay Peninsula.

SPILOSMYLUS PROXIMUS sp. nov.

Yellowish; face with faint dark spots below antennæ and on clypeus, vertex slightly darkened, antennæ pale; pronotum pale, a pair of dark spots in front part, and more elongate ones in hind part; four rounded dark spots on mesonotum and on anterior and lateral lobes; pleura and legs pale, tibiæ unmarked; abdomen faintly brownish. Forewings pale, a small dark cloud near middle of hind border; venation mostly very pale, costals unmarked, longitudinal veins scarcely at all dark, many crossveins in middle of wing wholly dark. Subcosta and radius with dark lines in only two places, the first near middle of wing, no line between these veins, and this space scarcely yellowish. Many of the hairs on costal crossveins, especially towards base, extremely long, erect, and black.

Hind wings with venation almost wholly pale.

Forewing with first crossvein from median to radial sector much before first branch of radial sector; twelve radial crossveins before stigma, twelve cubital crossveins, eleven branches of radial sector.

Forewing, length, 19 mm; width, 7.

MINDANAO, Davao Province, Galog River, altitude 6,000 feet, October 22 (*Clagg*). Type, M. C. Z. No. 20201.

SPILOSMYLUS ALTICOLUS sp. nov.

Head pale, face polished, without distinct marks; antennæ pale yellow, as also pronotum, latter with a black spot on each

side in front and behind, meso- and metanotum pale, unmarked, as likewise pleura; legs pale, unmarked; abdomen rather darker near tip.

Forewings hyaline; most veins pale, none dotted with dark; subcosta and radius with four pairs of black lines, and a narrow black line in membrane between, this space scarcely yellowish; costals wholly pale, many other crossveins dark, and branches of radial sector often partly dark; outer marginal forks pale, but a faint brown cloud parallel to outer margin, a little way back from it; bulla small, with two submedian dark lines, and a spot each side. Hind wings almost wholly pale, but the outer two rows of gradates dark, as also some streaks on radius and subcosta. Forewing with twelve radials, before stigma, twelve cubital crossveins, ten branches to radial sector, and first anal crossvein scarcely oblique (in most species very plainly so).

Forewing, length, 16 mm; width, 6.

MINDANAO, Davao Province, Mount Apo, Sibulan River, altitude 7,000 to 8,000 feet, September 6 (*Clagg*). Type, M. C. Z. No. 20202.

SPILOSMYLUS APOANUS sp. nov.

Head yellowish, polished, a faint dark mark on middle of lower face; antennæ pale yellowish; pronotum also yellowish and without definite marks, meso- and metanotum as well as pleura pale, unmarked; abdomen scarcely darker near tip; legs pale, faint marks on front and midtibiæ. Wings hyaline, veins pale, but often dotted with brown or with brown streaks, many crossveins through middle area of wing wholly dark brown and slightly bordered, the next to last median crossvein very broadly bordered, forming a prominent spot. Five pairs of streaks on radius and subcosta, the space between plainly yellowish, with a dark stripe between each pair of streaks, in some places that space hyaline white and the dark streak broken in the middle to form two exclamation marks. Bulla very similar to that of *S. modestus* and with a faint brown cloud above it; outer marginal forks mostly brown; usually a few small clouds of brown in apical gradates dark, and most other veins marked or dotted with brown. Forewings with twelve radial crossveins before stigma, one beyond, ten branches of radial sector, eleven or twelve cubital crossveins, first anal crossvein very oblique; first median crossvein to radial sector ends on the sector at or before the working of sector.

Forewing, length, 17 mm; width, 6.

MINDANAO, Davao Province, Seliban River, altitude 7,000 feet, September 3; Galog River, altitude 6,000 feet, September 8 and 12; both on Mount Apo (*Clagg*). Type, M. C. Z. No. 20203.

Three females (?) without bulla, from Seliban River, Galog River, and Tia Ridge, apparently belong with the specimens cited above; they are similar in markings, but the veins are more dotted and with fewer brown streaks; the subcosta and radius show a few dark streaks, and in some places an intermediate dark line. This species closely resembles *S. modestus;* but the dark streaks between radius and subcosta, and the first median crossvein ending before the fork, as well as the lack of pronotal marks, separate it.

CONIOPTERYGIDÆ

PARASEMIDALIS TAGALICA sp. nov. Plate 2, fig. 15.

Head yellowish, antennæ blackish brown, thorax above pale, with a large rounded brown spot on each lateral lobe of mesonotum, pleura and legs pale; wings an even gray color, unmarked. Antennæ of male very heavy, joints in basal part more than twice as broad as long. Forewing with crossvein from radial sector to radius well out on the fork; crossvein from cubitus to medius ending on medius nearly its length before the fork. Hind wing with crossvein from radius to sector out on the fork, no distinct crossvein from radial sector to medius.

Length, 1.8 mm.

MINDANAO, Davao Province, Calian, June 20; Lawa, May 5 (*Clagg*). Type, M. C. Z. No. 20210.

HELICOCONIS NOTATA Navas.

MINDANAO, Davao Province, Mount Apo, Seliban and Mainit Rivers, altitude 6,000 to 8,000 feet, September 8 to 10 (*Clagg*). LUZON, Mount Banahao.

SPILOCONIS INTERRUPTA sp. nov. Plate 2, fig. 14.

Face yellowish, dull; palpi dark; vertex pale, very much elevated, fully twice as broad as long, truncate in front, anterior corners rounded. Basal joint of antennæ and the next two yellowish, then eight joints blackish, then two yellowish, then five blackish, the rest pale. Notum and pleura brown, legs pale. Wings of an even gray color, no spots, radial sector and apical crossveins narrowly margined with hyaline; base of radial sector and crossvein back to medius wholly hyaline; medius with a small swelling a little before, and another about equally far

beyond, the crossvein; median and cubital crossveins interstitial, the three apical crossveins also forming a straight line across; radius near the base much bent.

Length, 2 mm.

MINDANAO, Davao Province, Mount Apo, Batraeyon, altitude 8,000 feet, September 14 (*Clagg*). Type, M. C. Z. No. 20211.

SERICOSTOMATIDÆ

GŒRA DISPARILIS sp. nov. Plate 5, fig. 44.

Head with yellowish hair, maxillary palpi with dark, white-tipped hairs; basal joints of antennæ pale, beyond brown and towards tip nearly black; most of the hairs on basal joint of antenna and on upper side of thorax dark with white tips; similar hairs on veins of forewings, particularly the costa, here some with the basal part plainly thickened, the fringe of similar black hairs, but usually without white tips; membrane of forewing, which is brownish, clothed with short golden hairs; hind wing gray to mostly black hair, fringe black; legs rather yellowish, tarsi darker, spurs black; abdomen dark brown. Venation of forewing normal (much as in *G. conclusa*), fork 1 going back almost halfway on discal cell. Hind wings with apical cells very long and slender, discal cell also very long, fork 2 reaching almost halfway to base of wing, fork 3 reaching back almost as far as fork 1. Female with hind tibiæ more curved even than in male, and in both a few of the short yellow spines of tarsi on the apical part of tibiæ.

Male genitalia on the plan of *G. impar* Ulmer, a pair of long, median, smooth, dark pieces close together, with blunt (not acute) tips, basad of these a pair of 2-jointed hairy flaps (*impar* shows only the apical joint), outside a very bristly lateral piece, longer than in *G. impar;* beneath, the lower plates show no inner, lobelike, hairy extension like that in *G. impar,* and the long, smooth, pear-shaped appendages with tapering tips reach almost as far out as the superior median pieces.

Sixth ventral segment with only three (five in *impar*) spines, the median one longer and, though enlarged at tip, the tip slightly bilobed.

Forewing, length, 9 mm.

MINDANAO, Davao Province, Mount Apo, Batraeyon, altitude 8,000 feet, September 14, and Sibulan River, altitude 2,000 feet, November 13 (*Clagg*). Type, M. C. Z. No. 22048.

GŒRINELLA APOANA sp. nov. Plate 5, figs. 49 and 51.

Brown, thoracic notum sometimes slightly yellowish, wings brown, costal area of forewings heavily black-haired; basal joint of antenna dark brown, beyond very pale; legs yellowish, spurs brown. Basal joint of antenna as long as head width, plainly a little bowed outward, densely clothed on inner side with short black hair, elsewhere with longer brown hairs; palpi at tip with dense short hair. Forewings with discal cell about as long as its pedicel; fork 1 only a little way back on discal cell, fork 2 as far back as 1, fork 3 rather broad at base, not as far back as base of discal cell; lower branch of cubitus at the crossvein bending down and uniting with anal for a short distance.

Lateral male appendages rather heavy, upcurved, inner tip with an elongate lobe or process, on outer tip a stiff tuft of dense black hair, so that the appendage appears bifid; superior appendages slender and forked, but from above the forking scarcely visible.

Female similar to male; basal antennal joint about as long as in male, but not bowed, and with much long hair; forewings with discal cell almost equal to its pedicel; forks 1 and 2 as in the male, fork 3 also just as long as fork 2, fork 5 not reaching back to the crossvein; second anal vein bending down before its end so that it almost touches the hind margin.

Expanse, 16 to 17 mm.

MINDANAO, Davao Province, Mainit River, altitude 6,000 feet, September and October; Galog River, altitude 6,000 feet, September 1 to November 8; and Sibulan River, altitude 7,000 to 8,000 feet, September 6; all on Mount Apo (*Clagg*). Type, M. C. Z. No. 22049.

GŒRINELLA BICOLOR sp. nov. Plate 5, fig. 45.

Head and thorax yellowish, abdomen and wings brown, antennæ dark brown, apical part almost black, legs yellowish, darker towards tips, hind tibia broadly dark in the middle. Basal joint of antenna longer than width of head, straight, densely long-haired all around. Vertex with partly yellowish hair from the warts, thorax with mostly gray hair, on sides some yellowish.

Forewing with discal cell extremely long and slender, much longer than its pedicel, fork 1 reaching back on discal cell much more than width of cell, fork 2 reaching back on discal cell

nearly width of cell, fork 3 arising plainly before fork 2, fork 5 reaching back to crossvein; apical cells all very long and narrow.

Expanse, 24 mm.

MINDANAO, Davao Province, La Lun Mountains, July 4 (*Clagg*). Type, M. C. Z. No. 22050.

CALAMOCERATIDÆ

ANISOCENTROPUS NITIDUS sp. nov. Plate 5, figs. 46, 50, and 52.

Head yellowish to gray, a tuft of yellowish hair inward from each eye and below antenna, some yellowish hairs on vertex; antennæ with basal joint pale, then brownish, especially above, for six to eight joints and gradually becoming pale, and below snow white for most of length. Thorax yellowish, rather brown in middle above, shining; legs pale, hind legs more gray to brown, the apical half of tarsi snow white, tibia and basal part of tarsus with long fringe, spurs scarcely darker than legs. Maxillary palpi with yellowish gray to almost brown hair, some short hairs nearly black; first and second joints subequal, third almost twice as long as second, fifth as long as third, fourth and sixth subequal, and each about two-thirds of fifth.

Forewings almost uniform brown, shining, sparsely clothed with short black hairs, denser towards the tip, the fringe here black, costal area slightly darker than elsewhere, veins a little darker than wing; hind wings gray, with gray hair.

Forewing slenderer than in most species; radius runs out parallel to subcosta till near tip where it forks, continuous curve running into costa, branch running into first apical sector. A crossvein from subcosta to radius above middle of discal cell, latter moderately slender; fork 1 back on discal cell hardly its width, fork 2 a still shorter distance on discal cell, fork 3 going a little before the radio-median crossvein, and the same distance before median crossvein, fork 4 hardly reaches crossvein and fork 5 to just a little before crossvein. Hind wing with fork 1 very long and slender, forks 2 and 3 much shorter and subequal, fork 5 about as long as 3, but much wider throughout, crossvein back to medius very oblique.

Male genitalia with a pair of slender superior appendages, tipped with long stiff hairs, a smooth, reddish, lateral spine shorter than superior appendage, and a pair of lower appendages, also shorter than the superior pair, and with extremely long hairs from near tip.

Forewing, length, 10 to 12 mm.

MINDANAO, Davao Province, Mainit River, altitude 6,000 to 6,500 feet, September 14, 22, and 24, October 23 and 24; Galog River, altitude 6,000 feet, September 26 and November 6; Sibulan River, altitude 8,000 feet, September 6; all on Mount Apo (*Clagg*). Many specimens. Type, M. C. Z. No. 22052.

This species resembles *Ganomena pallicorne* McLachlan, but is much smaller.

LEPTOCERIDÆ

Key to the Philippine species of Œcetis.

1. In hind wing the crossvein runs to medius before forking of medius.... 2.
   In hind wing the crossvein connects the forks..... 4.
2. Antennæ of male thickened on the basal part; size moderate. *crassicornis.*
   Antennæ of male not thickened; very small species..... 3.
3. In forewing besides the hairs there are black broad-tipped scales along the veins; fork 4 does not reach the crossvein, crossvein from radial sector to medius before end of discal cell..... *apicipennis.*
   In forewing no such scales; fork 4 reaches the crossvein, crossvein from radial sector to medius just beyond end of discal cell..... *claggi.*
4. Anastomosis in one transverse line; fork 4 hardly reaches crossvein; fringe extremely long ..... *pilosa.*
   Anastomosis widely disjointed; fork 4 goes back before crossvein; fringe moderate ..... *separata.*

Œcetis apicipennis Banks was described as a *Setodes;* it is very similar to *Œcetina angusta* Banks, of Borneo; both have the peculiar black scales; these and some of the others will doubtless constitute new genera some day.

ŒCETIS CLAGGI sp. nov. Plate 6, fig. 56.

Head, legs, and antennæ pale yellowish, almost white, latter annulate with brown; thorax and abdomen more rufous. Forewings nearly clear, crossveins brown; membrane and veins and margin with many long pale hairs; hind wings pale, with pale hair and fringes.

Forewings very slender, front and hind margin nearly parallel, discal cell extremely long and slender, fork 1 back scarcely a bit on discal cell, fork 4 reaching scarcely before crossvein; crossvein at end of discal cell a little before crossvein to medius, crossvein from medius to fork 4 a considerable distance before the others, branch of cubitus still farther before the last crossvein; anal vein running out a long distance beyond this branch close and parallel to the hind margin. Hind wings with crossvein ending long before fork of medius, fork 3 no longer than its pedicel; work 5 fairly long.

Male genitalia with a pair of large elliptical plates above, covered with short white hair, arising from below a pair of long upcurved slender spines.

Forewing, length, 4.5 mm.

MINDANAO, Davao Province, Mount Mayo, altitude 4,000 to 5,000 feet, January 26 (*Clagg*). Type, M. C. Z. No. 22055.

ŒCETIS SEPARATA sp. nov. Plate 6, figs. 57 and 59.

Pale yellowish; white hair on head and thorax above, abdomen white till near yellowish tip; antennæ, palpi, and legs pale yellowish, antennæ narrowly annulate with brown, very slender (not as in *Œcetodella*). Wings faintly grayish, with long fine gray to yellowish hair, very long on veins, fringe mostly pale, some brown patches along outer side, fringe beyond ends of anal veins very long and bright yellow; veins gray, over most of the forkings brown spots, one at end of anals, and one on subcosta at about middle of discal cell, crossveins brown, no spots at ends of apical veins; hind wings nearly hyaline, with yellowish gray hair and fringe.

Forewings with the anastomosis much disjointed, the radio-median crossvein long before the end of discal cell, median crossvein about halfway between them, discal cell longer than second apical vein, fork 1 back on discal cell about width of the cell. Hind wings with crossvein connecting forks as in *Œcetodella*.

Genitalia somewhat on the plan of *Œ. scutata* Ulmer, from Sumatra, but parts slenderer; lower appendages curving up nearly twice as far as in that species; median superior piece elongate, widened near middle, then narrowed a bit before the scarcely rounded tip; superior lateral appendages projecting from each side of median piece and longer than it, almost touching the end of lower appendages.

Forewing, length, 7 mm.

MINDANAO, Davao Province, Mount Mayo, altitude 4,000 to 5,000 feet, January 29 (*Clagg*). Type, M. C. Z. No. 22056.

ŒCETIS PILOSA sp. nov. Plate 6, fig. 58.

Pale yellowish, antennæ with tips of joints dark, male antennæ not swollen on basal part, thorax and tips of abdomen slightly reddish brown. Forewings faintly gray, with extremely long dark hairs on veins and along margins, posterior fringe more than one-half the width of wing; along outer half of costa the hairs very dense, making a brown streak, among the bases of these hairs are shorter ones, some of them snow white, and also some iridescent scales; between the veins are very few hairs,

mostly towards base; at anastomosis three tufts of black hair, another at base of fork 1 on upper edge of discal cell, a patch of dark brown hair at end of anal vein, three or four apical veins brown at tips; hind wings with brown hair on veins and along margin, the fringe behind in places longer than width of wing.

Forewing with discal cell much longer than its pedicel, fork 1 back on discal cell a little more than cell width, fork 4 not quite reaching to crossvein; crossveins of anastomosis nearly on a transverse line, and slightly brown. In hind wing the crossvein connecting the forks, fully twice its length from base of forks, the forks subequal in length, fork 5 rather short. Male genitalia show above at base a broad membranous plate, bent down on sides, tip broadly trilobed, lateral lobes ending in a dark knob, median lobe broad; ventral appendages hardly noticeable from side, moderately slender, tips slenderer, in one view with a deep inner emargination and an apical rounded lobe; two intermediate processes very slender, reddish.

Forewing, length, 7 mm.

LUZON, Laguna Province, Mount Maquiling (*Baker*). Type, M. C. Z. No. 22057.

TRLÆNODES BOETTCHERI Ulmer.

MINDANAO, Davao Province, Mount Apo, September to November.

Besides the row of black spots across the apical field, there are several black tufts on the anastomosis, and one near hind margin about halfway to end of anal vein.

SETODES FLAVIPENNIS sp. nov. Plate 6, figs. 60 and 62.

Pale yellowish; face, vertex, and thorax with white hair; forewings with rather bright yellowish hair, faintly annulate with brown in apical part; apical fringe yellowish, but a little brownish near extreme apex; hind wings hyaline, with long, white posterior fringe; legs yellowish; abdomen brown, with brown to greenish venter. In hind wings fork 1 small, but distinct, fork 3 a little shorter than pedicel, fork 5 large, a little before forking of median. In forewing pedicel of fork 1 fully one-third of fork, fork 3 a little before fork 1.

Male genitalia with upper appendages long and slender, but close together at base, inferior appendages with an erect bristly process above, and a smaller, more pointed one just beyond it. Penis with two divergent lobes at tip, seen from side there are two spines, the intermediate processes extremely slender.

Length, 5 mm.

NEGROS, Occidental Negros Province, Victorias, October 21, 1927, and November 1, 1927, at light (*W. D. Pierce*). Type in the United States National Museum; paratype, M. C. Z. No. 22053.

This species is evidently related to *S. spinosella* Ulmer, but the genital parts differ.

ALLOSETODES ASSIMILIS sp. nov. Plate 6, figs. 61 and 64.

Head with gray hair below, yellowish on vertex; antennæ pale, very plainly annulate with brown; palpi with brown hair, legs pale, tibiæ and tarsi brown. Forewings largely black, more uniformly so than in *A. plutonis,* with long black hair and small iridescent scales which appear golden in certain views; fringe black; hind wings dark, with black hair, and brown to black fringes. Forewing with discal cell much longer than its pedicel, fork 1 but little more than one-half its pedicel, fork 2 truncate at its base, third apical vein arising from near middle of end of discal cell, fourth and fifth apical cells also truncate at base, the branch of cubitus running into the anal vein which here almost touches the margin; in hind wings, which are very slender and pointed at tip, fork 1 very short, fork 2 nearly halfway to base of wings, with a short pedicel, median vein about opposite base of discal cell stopping and running no farther basad.

Male genitalia very similar to those of *A. plutonis;* with three slender pieces at base above, the median one forked at tip and hairy only at tip, side pieces shorter, with long bristles; below this is the long, down-curved, smooth median piece, somewhat shorter than in *A. plutonis;* below are the ventral appendages, from the side the basal part is thick, though at one place much constricted, and bears above near its base a slender upward projection tipped by a very long bristle (not seen in *A. plutonis*).

Forewing, 5 to 5.5 mm.

MINDANAO, Davao Province, Sibulan River, altitude 7,000 to 8,000 feet, August 31; Todaya Plateau, altitude 5,000 feet, September 12; Galog River, altitude 6,000 feet, September 26; all on Mount Apo (*Clagg*); Mount Mayo, altitude 4,000 to 5,000 feet, January 28 (*Clagg*). Type, M. C. Z. No. 22054.

When I described this genus (1931) I figured the venation of a denuded wing which proved to be abnormal; I have denuded another wing of *A. plutonis* and find it similar to that of *assimilis,* here figured, and much like that of *Triænodes.* The anal vein, however, runs in the apical part so close to the hind margin

as almost to touch it, and in *A. plutonis* the anal vein runs out at the end of the branch from the cubitus. In *A. plutonis* fork 2 is not so broad at base as in this species and not one-half as broad as the second apical cell; the hind wings are slenderer and more pointed than in *Triænodes,* thus the name may be retained, at least as a subgenus.

HYDROPSYCHIDÆ

HYDROPSYCHE FORCIPATA Ulmer. Plate 3, fig. 31.

What I take to be this species is common on Mount Apo up to 6,000 feet, and in other parts of Mindanao. The apical part of the claspers is as Ulmer figures them, the tip of the superior appendage has the pair of slender caliperlike pieces; in all my specimens there is a distinct swelling below the base of these processes not shown by Ulmer. The penis has the apical part as Ulmer figures it, but before this there is a flat process with a pair of teeth above at base, and each lateral part with two sharp teeth directed backward. However, I think there is no doubt about the identification; all my specimens are dry.

HYDROPSYCHE RIZALI sp. nov. Plate 4, figs. 39 and 41.

Head densely clothed with yellowish hair; thorax above with appressed yellowish hair; antennæ yellowish, narrowly banded with brown; palpi and legs pale yellowish, also spurs. Forewings yellowish, densely transversely marmorate with brown, apical fringe black in patches; hind wings pale. Discal cell about two and one-half times as long as broad; fork 1 with a pedicel one-half of discal cell, fork 2 black on discal cell less than width, fork 3 back as far as the dot of fork 2, forks 4 and 5 as far back as base of discal cell.

Hind wings with fork 1 plainly shorter than its pedicel, fork 2 back on discal cell more than one-half length of cell. Male genitalia somewhat similar to those of *H. forcipata,* apical parts of superior appendage not curved out, but from side suddenly bend downward, apical part of claspers not as sinuous as in *H. forcipata,* penis with an elongate flap each side of tip similar to that of *H. forcipata,* but not nearly as large, tip with two sharp teeth, a pair of scabrous, elongate processes directed backward.

Forewing, length, male, 11 mm; female, 14.

MINDANAO, Davao Province, Mount Mayo, altitude 4,000 to 5,000 feet, January 26 (*Clagg*). Type, M. C. Z. No. 22066.

Its size and appearance are those of *H. faurei* Navas, of which I have a female from Haight's Place, Mountain Province, Luzon; but the male genitalia (as figured by Navas) are very different; the terminal parts of the females also differ somewhat.

Key to the Philippine species of Hydropsychodes.

1. Wings yellowish, more or less marmorate with brown ..... 3.
   Wings black, with white spots or bands ..... 2.
2. With four or five narrow white bands on forewings, one of them subapical, one basal ..... *albocincta.*
   With several large, mostly costal, and numerous other small pale spots, none in apical area ..... *costalis.*
3. Apical part of clasper widened towards tip, and excised on outer side. *excisa.*
   Apical part of clasper tapering ..... 4.
4. Apical part of clasper short, thick at base, pointed at tip ..... *masi.*
   Apical part of clasper slender throughout ..... *normalis.*

HYDROPSYCHODES NORMALIS sp. nov. Plate 4, fig. 40.

Head and thorax above with pale yellowish gray hair; antennæ pale, annulate with brown; palpi, legs, and spurs pale yellowish. Forewings yellowish, densely speckled and marmorate with brown, often, towards tip especially, quite dark, much darker than in *H. masi*, sometimes as in that species with dark patches near ends of veins; hind wings yellowish gray.

Forewings with discal cell fully two and one-half times as long as broad, fork 1 with pedicel two-thirds of fork, fork 2 only a very short distance back on discal cell, fork 3 hardly reaching the dot of fork 2, forks 4 and 5 start about opposite crossvein from medius to radial sector. In hind wing fork 2 goes back on discal cell about width of latter. Male claspers very slender, the apical part also very slender; superior appendage broad and nearly truncate at tip, with a lobe below each corner; penis slender, enlarged at tip in two lobes with point downward.

Forewing, length, 6 mm.

MINDANAO, Davao Province, Libby, December 9 (*Clagg*); many specimens. Type, M. C. Z. No. 22063.

Readily separated from *H. masi* by the slender apical part of claspers.

HYDROPSYCHODES ALBOCINCTA sp. nov. Plate 4, fig. 43.

Head black, white hair on face, vertex with long, nearly black hair; antennæ pale, annulate with brown; palpi dark brown; thorax dark, with mostly dark hair, some white on pronotum;

legs with dark femora and tibiæ, usually pale on base of tibiæ, tarsi partly pale, with some dark spaces.

Forewings black, with five white bands, one over the base, a second before end of basal third, forked behind, one over base of discal cell, one from stigmal region not reaching across, and one subapical, slightly curved, and also not reaching across; hind wings wholly dark.

Forewing with discal cell hardly two and one-half times as long as broad, fork 1 with a very short pedicel, fork 2 only a trifle back on discal cell, fork 3 not reaching opposite the dot of fork 2, forks 4 and 5 about opposite middle of discal cell; hind wings with fork 2 back on discal cell not width of latter.

Male genitalia with claspers slender, the apical part especially so, tip sharp and incurved, superior appendage broad, nearly truncate at tip, with a rounded projection at each corner; penis similar to others, with two lobes at tip, more separated than usual.

Forewing, length, 5.5 to 6 mm.

MINDANAO, Davao Province, Lawa, Mount Apo, Galog, Mainit, and Seliban Rivers, September 17 to November 4 (*Clagg*). Type, M. C. Z. No. 22064.

HYDROPSYCHODES MASI Navas.

I have a paratype; it has the apical part of the clasper short and stout at base as figured by Ulmer for *H. marmorata,* based on a female. If Ulmer's identification is correct, *H. marmorata* is the female of *H. masi:*

Key to the Philippine species of Diplectrona.

1. With more than one white band on forewing ..... 2.
   With but one or no white band on wings ..... 4.
2. The two median dark bands with a golden center; third band much wider than second ..... *exquisita.*
   Median dark bands without a golden center; the third, or stigmal, band but little, if at all, wider than second ..... 3.
3. Forewing all black, except three white bands, the third entire. *trifasciata.*
   Forewing yellowish except along costa and the apical area, third band broken ..... *tricolor.*
4. Wings wholly dark, no pale band ..... 7.
   Wings with pale median band, or almost wholly pale ..... 5.
5. Head and thorax dark; wings dark, with a pale median band. *cinctipennis.*
   Head and thorax yellowish, with yellow hair ..... 6.

6. Forewing fairly dark, with a distinct median pale band..... *fasciata.*
   Forewing mostly pale yellowish, with a black streak over stigmal area, pale band indistinct ..... var. *stigmatica.*
7. Forewing 8 mm long; male claspers scabrous beneath..... *scabrosa.*
   Forewing 5 mm long; male claspers not scabrous beneath..... *bidens.*

DIPLECTRONA SCABROSA sp. nov. Plate 4, fig. 38.

Head black, front shining, some dark hair below and on vertex; antennæ and palpi black, latter paler near tip; pronotal lobes yellowish and with yellowish hair, rest of thorax black, lobes in front of wings yellowish; legs yellowish, tarsi dark, as also spurs; abdomen brown.

Wings entirely blackish, clothed with short black hair, upper base of median cell and first anal vein towards base very narrowly margined with hyaline, a hyaline dot over end of anal vein; hind wings as dark as the forewings. Hind wing with the venation much like that of *fasciata,* fork 5 widened near base as in that species; forewing with the crossvein back from base of median fork widely disjointed at the cubitus.

Male appendages with basal part of claspers very much roughened below and with stiff hairs, apical portion of clasper very slender and pointed; superior processes with tips sharp and outcurved.

MINDANAO, Mount Apo, Sibulan River, altitude 700 to 800 feet, September 6 (*Clagg*). Type, M. C. Z. No. 22059.

I have a female *Diplectrona* from Mount Maquiling, Luzon, which may be *D. bidens* Ulmer. It is wholly dark and of the right size, the legs yellow brown, tarsi paler. The crossvein back from base of median fork is continuous as usual; fork 5 of hind wing hardly widened near base.

DIPLECTRONA FASCIATA var. STIGMATICA var. nov. Plate 5, fig. 48.

Specimens from Mount Apo are larger and very much paler than the typical *fasciata;* wing not darkened except for a prominent long dark streak over stigmal region; white band present, but scarcely noticeable on account of pale yellowish background; yellowish cast on base of forewing of typical *fasciata* here extending out to the white band; hind wing with a slender, curved, dark streak over and behind the union of subcosta and radius. Head and thorax yellowish.

Male genitalia very similar to those of *fasciata,* the superior processes not curving outward as much as in *fasciata,* tip of penis, in side view, showing a slender, curved prong above, which I cannot find in *fasciata.*

Expanse, 18 to 21 mm.

MINDANAO, Davao Province, Mount Apo, Mainit River, altitude 6,000 feet, September 7, 10, 14, and 22, October 21; Galog River, altitude 6,000 feet, October 23, November 4 (*Clagg*): Zamboanga (*Clark*). LUZON, Mountain Province, Baguio (*Baker*). Type, M. C. Z. No. 22061.

DIPLECTRONA TRICOLOR sp. nov. Plate 4, fig. 37.

Face yellowish, front dark, vertex mostly pale and with yellowish hair, palpi brown, antennæ with basal part pale, then gradually marked with brown until almost wholly brown; thorax yellowish, with yellowish hair; legs pale yellowish, front tarsi and spurs darker; abdomen brown above, pale beneath, appendages pale. Forewings with three white bands and a part of a fourth near base, apical band interrupted, upper portion with a projection towards tip of wing where there is a white spot along the margin; veins with black hairs, general surface with appressed yellowish hair, along the costal border and in most of the apical area densely covered with dark brown hair, costal parts shading behind into pale, a pale streak in the interruption of apical band; the three white bands fairly narrow and subequal.

Hind wings pale, with mostly scattered dark hair, the apical part dark brown, here a large white spot opposite the subapical band of forewings. Venation of hind wings very similar to that of *fasciata,* but fork 5 scarcely, if at all, wider near base, and thus not approaching the vein in front as closely as in *fasciata.* Forewings with crossveins extremely faint, that closing the median cell most distinct, that from the base of the median fork back across cubitus not visible; discal cell rather slenderer than in *fasciata.*

Male appendages with apical part of claspers very slender; superior processes with apical point sharp and much outcurved.

Expanse, 20 mm.

MINDANAO, Davao Province, Mount Mayo, altitude 3,000 to 4,000 feet, January 28 (*Clagg*). Type, M. C. Z. No. 22058.

DIPLECTRONA EXQUISITA sp. nov. Plate 4, fig. 35.

Head black, with snow-white hair, palpi dark brown, antennæ with basal joint pale, beyond dark brown for about fifteen joints, beyond white; thorax brown, pronotum with white hair; legs brown, tips of front femora pale, front and midtibiæ with appressed white hair on outer side, mid- and hind tarsi white on basal half, upper spurs partly white, apical spurs brown; abdomen dark brown.

Forewings with three white bands, between them, and towards base, and the apical part brown; the two submedian brown bands contain a band of golden hair; first white band much wider behind than in front, second white band narrower than first, a little wider in front than behind, third white band about twice as broad as second, narrowly interrupted in middle by brown along a vein, behind not quite reaching hind margin; near tip of wing three small white spots between veins, and trace of a fourth. Hind wings fumose, brown in apical and costal parts, here a large white spot opposite the third white band of forewing, a white costal streak opposite the middle white band of forewing.

Hind wings with venation similar to that of *fasciata,* but fork 5 is not widened near base. Forewings also with venation similar to that of *fasciata,* all the forks rather more elongate than in that species. Male appendages with claspers much as in *fasciata,* the apical part with blunt tip, the basal part with tawny hair below; superior processes with a slender, sharp, outturned tip.

Expanse, 14 mm.

LUZON, Laguna Province, Mount Maquiling (*Baker*). Type, M. C. Z. No. 22060.

TINODES TAGALICA sp. nov. Plate 3, fig. 30.

Black; head with some white hair in front and between the antennæ, darker hair on vertex; palpi dark, especially the large joints; antennæ brown, narrowly annulate with pale at tips of joints; legs dark; in male the base of midtibia and the whole of midtarsus white, spurs dark; wings dark, with black hair.

Forewings with discal cell scarcely twice as long as broad at tip, fork 2 back a trifle on the discal cell, fork 3 about two-thirds as long as fork 2, fork 4 about equal in length (but base before) to fork 3, fork 5 reaching back to before base of discal cell. In hind wings fork 2 back to the crossvein to medius, fork 3 with a short pedicel.

Male genitalia with a broad superior basal piece, beneath it a slender, reddish, down-curved piece with a tiny process at tip, on each side the very slender lateral appendages, very hairy, and below a pair of rather heavy elongate pieces with a small projection at lower tip. Female ovipositor upcurved, nearly one-half the length of abdomen.

Forewing, length, 4.5 mm.

MINDANAO, Davao Province, Mount Mayo, altitude 4,000 to 5,000 feet, January 27; Mount Apo, Mainit River, altitude 6,000 feet, September 14; Sibulan River, altitude 2,000 feet, November 13; and Baroring River, altitude 7,000 feet, November 9 (*Clagg*). Type, M. C. Z. No. 22067.

TINODES ADJUNCTA sp. nov. Plate 3, fig. 32.

Head brownish, with yellowish to dark hair; antennæ brownish, annulate with pale; palpi brown; thorax pale in middle, brown on sides; legs pale, spurs brown, tarsi brownish.

Forewings dark, clothed with short golden and black hairs; hind wings gray, with scattered black hairs. In forewings discal cell a little more than twice as long as broad, fork 2 back about one-half cell width on discal, fork 3 a little longer than its pedicel, fork 4 hardly as long as fork 3, fork 5 plainly a little longer than fork 4.

Hind wings with fork 2 back to crossvein, fork 3 back a little before crossvein, fork 5 large and wide. Male genitalia with a broad basal piece above, with a median process, a pair of slender lateral bristly appendages, a broad lower plate, and a broad median reddish piece, down-curved, with a pair of spines before tip and below a pair of recurved spines.

Forewing, length, 5 mm.

MINDANAO, Davao Province, Mount Apo, Galog River, altitude 6,000 feet, and Todaya Plateau, altitude 5,000 feet, October 2 (*Clagg*). Type, M. C. Z. No. 22068.

POLYPLECTROPUS GRANDIS sp. nov. Plate 4, fig. 36.

Head clothed with golden hair, some more tawny hair near posterior middle of vertex; pronotum also with tawny hair, also on the sides of mesonotum, but that on middle of mesonotum pale yellowish; antennæ yellowish, each joint rather broadly marked with brown; palpi yellowish, basal joints more brown; legs dull yellowish, femora more brownish, spurs tawny.

Forewing rich brown, quite densely marked with square to rounded pale yellow spots, most of them between the veins, nearly all of them small, but a much larger one near middle of posterior margin; no spots in basal part of fork 2 or in adjoining areas; a few of the spots tend to form bands, but most of them do not; hind wings dark, with blackish hair.

Forewings with fork 1 about as long as its pedicel, fork 2 starting at end of discal cell, fork 3 two-thirds as long as fork

2, fork 4 reaching back a little before median crossvein, fork 5 reaching nearly to base of median cell.

Male genitalia appressed to tip of abdomen so as to be inconspicuous; two long spines subparallel seen from behind, bending downwards, each arising from an elongate plate, the lower part of which is scabrous; ventral pieces jet black and with a spinelike process directed backward from near their tips, seen from above these pieces are very broad and nearly truncate.

Forewing, length, 10 mm.

MINDANAO, Davao Province, Mount Apo, Galog River, altitude 8,000 feet, October 18 (*Clagg*). Type, M. C. Z. No. 22069.

POLYPLECTROPUS ULMERI sp. nov. Plate 3, fig. 28.

Head and thorax densely clothed with yellowish hair; antennæ, palpi, and legs yellowish. Forewings brown, with many small, narrow, transverse patches of yellow hair, most numerous beyond the middle and tending to form transverse bands; fringe almost wholly brown; hind wings with blackish hair and fringes.

Venation similar to that of other species; fork 1 shorter than its pedicel, fork 2 starting from the discal cell, fork 3 hardly more than one-half of fork 2, fork 4 scarcely longer than 3, fork 5 very long.

Male genitalia remarkable in having the spinelike processes extremely long and slender, wholly down-curved, and subparallel to each other (much longer than in other species); median superior appendage a rather slender spinelike process deeply forked at tip; ventral pieces extremely hairy, rather long and heavy, and separated by their width.

Forewing, length, 5 mm.

LUZON, Laguna Province, Los Baños (*Baker*). Type, M. C. Z. No. 22070.

Genus DOLOCLANES novum

A philopotamine; ocelli present; posterior warts large; spurs, 2, 4, 4; midtibia of female not dilated; palpi with first three joints large, fourth rather more slender, last as long as third and fourth together, much more slender, slightly curved, the apical part appearing as a separate segment.

Discal cell very short, closed (though faintly) in both wings, in forewings above with an oblique crossvein towards radius but not reaching that vein; in forewing forks 1 to 5 present, in hind wings forks 1, 2, 3, and 5, fork 5 in both wings very large and long; in forewings forks 1 and 2 reaching discal cell,

in hind wings fork 2 reaching discal cell, fork 1 very short, its upper edge running into radius near end of radius.

Type of the genus, *Doloclanes montana* sp. nov.

Distinct by the very short discal cell with extremely long pedicel, the incomplete crossvein above discal cell, and by the first apical vein of hind wing running into radius.

DOLOCLANES ALTICOLA sp. nov. Plate 3, figs. 25, 27, and 29.

Head dark, clothed with mostly dark hair; palpi brown; antennæ brown, barely annulate with pale; thorax dark, with mostly dark hair, some paler on sides; legs brown, especially front legs and spurs, hind legs more yellowish brown, tibia with long hair. Wings dark, with dark hair, apical fringe black, a hyaline spot over end of discal cell and behind it.

Forewings with discal cell hardly twice as long as broad, fork 1 back on discal cell two-thirds of cell, fork 2 scarcely back on discal cell, fork 3 fully two-thirds of fork 2, but much longer than pedicel, fork 4 fully as long as fork 3, fork 5 extremely long, almost back to forking of medius.

Hind wings with fork 1 shorter than pedicel, its upper vein running into radius fully width of cell before end, fork 2 back to discal cell, very slender, fork 3 hardly more than one-half of fork 2, fork 5 very long.

Male genitalia with two slender pieces above, the lower pieces 2-jointed, basal joint broad and heavy, apical about as long, slender (except base), and with a down-curved tip, between them the intermediate piece, which has a blunt tip and extends scarcely beyond the basal part of lower appendage.

Forewing, length, 4 to 4.3 mm.

MINDANAO, Davao Province, Mount Apo, Galog River, altitude 6,000 feet, October 19; and Mainit River, altitude 6,500 feet, October 22 (*Clagg*). Type, M. C. Z. No. 22072.

DOLOCLANES MONTANA sp. nov. Plate 3, fig. 26.

Head yellowish brown, with mostly pale hair, some hairs on each side of vertex dark; palpi pale brown; antennæ pale; thorax with mostly pale hair, some on outer sides of pronotum dark; legs pale, hind tibiæ very hairy. Wings dark, clothed with short black hair and fringes; a faint hyaline mark at end of discal cell and over crossvein behind to medius.

Forewings with discal cell about twice as long as broad, with an extremely long pedicel; fork 1 going back on discal cell less than one-half width of cell, fork 2 back a trifle on discal cell,

fork 3 only about one-half as long as fork 2, hardly as long as its pedicel, fork 4 slightly longer than 3, fork 5 reaching back almost to forking of medius.

Hind wings with discal cell also very short, fork 1 short, its upper edge running into the radius as the latter ends, fork 2 back to discal cell, fork 3 not one-half length of 2, pedicel much longer than fork, fork 5 large and long.

Male genitalia with a pair of parallel, subclavate, superior appendages, below a pair of longer, 2-jointed appendages, basal part heavy and broad at base, apical part about two-thirds of basal and more slender, within is a median piece with a slender, upcurved, spinelike tip.

Forewing, length, 5 mm.

MINDANAO, Davao Province, Mount Mayo, altitude 4,000 to 5,000 feet, January 27 (*Clagg*). Type, M. C. Z. No. 22071.

ECNOMUS RIZALI sp. nov. Plate 5, fig. 54; Plate 6, fig. 63.

Head dark, with mostly dark hair, some yellowish between antennæ; antennæ dark, annulate with pale; palpi dark, thorax with yellowish hair through middle, dark on sides; legs yellowish to yellow-brown, tarsi dark, annulate with pale.

Forewings brown, with many, small, scattered patches of golden hair, the larger ones at intervals near hind margin; hind wings gray, with black hair and fringes. Forewings with discal cell a little more than twice as long as broad, fork 1 about as long as its pedicel, longer than fork at end of radius, fork 2 back a trifle on discal cell, fork 3 about twice as long as its pedicel, fork 4 back a trifle on crossvein, fork 5 not as long as fork 4.

Hind wings with fork 2 plainly longer than its pedicel, fork 5 shorter than 2.

Male genitalia from above show two long, slender, slightly curved processes, with the lower appendages heavy and their tips recurved within, from the side the lower appendages have a long basal part, and a slenderer, upcurved, apical part.

Forewing, length, 5 mm.

MINDANAO, Davao Province, Mount Mayo, altitude 4,000 to 5,000 feet, January 27 and 28 (*Clagg*). Type, M. C. Z. No. 22073.

Key to the Philippine species of Chimarrha.

1. Radial sector just before discal cell not bent, discal cell triangular, no bare space before it ..... *recta.*
   Radial sector just before discal cell plainly bent, and a smooth space behind and sometimes above it..... 2.

2. Length of forewings less than 4 mm ..... 3.
   Length of forewings plainly more than 4 mm ..... 4.
3. Crossvein at end of discal cell and one behind it white; antennæ and palpi fulvous ..... *leucophlebia.*
   Crossvein not white; antennæ and palpi brown ..... *alticola.*
4. Discal cell triangular, base almost pointed; forewings about 6 mm long. *tagalica.*
   Discal cell almost quadrangular, much widened near base; forewings about 5 mm long ..... *luzonica.*

CHIMARRHA TAGALICA sp. nov. Plate 5, fig. 53.

Head and thorax yellowish, clothed with pale golden hair; palpi (except pale base) brown; antennæ pale, very narrowly annulate with dark and becoming brownish towards tip; legs pale dull yellowish, front tibiæ and tarsi brown; spurs brown.

Forewings clothed with short yellowish and black hairs producing a uniform dull yellowish color, a large bare space just beyond the forking of radius, fringe dark brown on costa, more gray along hind margin; hind wings gray.

Forewings with radial sector from base to discal cell strongly bent to form the bare cell, and also a smaller, slightly swollen, bare space behind radial sector just before discal cell; discal cell triangular, tip slightly oblique. Forks 1 and 2 sessile on discal cell, fork 3 subequal to its pedicel, fork 5 back as far as base of discal cell. Male genitalia showing two long, straight, hairy, pale inferior appendages, a dark brown, somewhat clavate, lateral appendage, and between these two membranous processes, each tipped by a long, straight black spine.

Forewing, length, 6 mm.

MINDANAO, Davao Province, Mount Apo, Galog River, altitude 6,000 feet, October, 19; Mount Mayo, altitude 4,000 to 5,000 feet, January 26 (*Clagg*). Type, M. C. Z. No. 22075.

CHIMARRHA ALTICOLA sp. nov. Plate 5, fig. 55.

In size, in the shape of discal cell, and the bent radial sector before it, and the short fork 3 this species agrees closely with the figure of *C. leucophlebia* Navas from northern Palawan. The median cell, however, is more elongate, and all apical cells are very much longer, so the discal cell is about twice its length from the tip of wing.

Head dark, hair pale yellowish, but a dark tuft on vertex each side by the eyes; palpi and antennæ dark brown (fulvous in *leucophlebia*) ; yellowish or fulvous hair on thorax as well as some dark hair.

Wings dark, clothed with black hair, in certain lights showing scattered golden hairs, end of discal cell no paler than other

veins (white in *leucophlebia*); fork 1 extends back a little on discal cell, but fork 2 does not, fork 3 much shorter than its pedicel. Hind wings with fork 1 going back a little on discal cell, the latter only about one-half as long as in forewing, fork 3 very short.

Legs pale yellowish, hind tibia and tarsi darker, spurs brown.

Male genitalia with a pair of heavy lower appendages, somewhat bent, tip oblique and faintly concave, tipped with a tapering incurved piece.

MINDANAO, Mount Apo, Sibulan River, altitude 7,000 to 8,000 feet, September 6, Galog River, altitude 6,000 feet, November 4; Mount Mayo, altitude 4,000 to 5,000 feet, January 26 (*Clagg*). Type, M. C. Z. No. 22074.

ILLUSTRATIONS

Plate 1

Fig. 1. *Ophiodopelma multipunctata* Hagen; forewing.
2. *Cæcilius nitoris* sp. nov.; forewing.
3. *Seopsis tricolor* sp. nov.; forewing.
4. *Cæcilius claggi* sp. nov.; forewing.
5. *Seopsis luzonica* sp. nov.; fore and hind wings.
6. *Micropsocus basalis* sp. nov.; forewing.
7. *Cæcilius otiosus* sp. nov.; forewing.
8. *Psocus alticolus* sp. nov.; forewing.
9. *Psocus incomptus* sp. nov.; head from above, and in front.
10. *Epipsocus prominens* sp. nov.; forewing.
11. *Chrysopa mindanensis* sp. nov.; venation near divisory cell.

Plate 2

Fig. 12. *Psocus dolorosus* sp. nov.; forewing.
13. *Hemerobius rizali* Banks; genitalia, side.
14. *Spiloconis interrupta* sp. nov.; forewing.
15. *Parasemidalis tagalica* sp. nov.; forewing.
16. *Chrysopa derota* sp. nov.; venation near divisory cell.
17. *Epipsocus prominens* sp. nov.; forewing.
18. *Cæcilius conspicuus* sp. nov.; forewing and head.
19. *Pseudocæcilius innotatus* sp. nov.; forewing.
20. *Neoperla bakeri* Banks; genital process.
21. *Neoperla claggi* sp. nov.; genital process.
22. *Chrysopa apoana* sp. nov.; venation near divisory cell.
23. *Chrysopa apoana* sp. nov.; veins between radius and radial sector.
24. *Hemerobius vagans* sp. nov.; male genitalia, side.

Plate 3

Fig. 25. *Doloclanes alticola* sp. nov.; forewing.
26. *Doloclanes montana* sp. nov.; part of forewing, genitalia, side.
27. *Doloclanes alticola* sp. nov.; genitalia, side and above.
28. *Polyplectropus ulmeri* sp. nov.; genitalia, side, below, penis.
29. *Doloclanes alticola* sp. nov.; hind wing and palpus.
30. *Tinodes tagalica* sp. nov.; genitalia, side and above.
31. *Hydropsyche forcipata* Ulmer; penis, and superior median piece.
32. *Tinodes adjuncta* sp. nov.; genitalia, below, side, and median piece.
33. *Neoperla obliqua* sp. nov.; genital process and area.
34. *Neoperla recta* sp. nov.; genital process and area.

PLATE 4

FIG. 35. *Diplectrona exquisita* sp. nov.; forewing, genitalia above, clasper, and penis.
36. *Polyplectropus grandis* sp. nov.; genitalia below, and side.
37. *Diplectrona tricolor* sp. nov.; forewing, part of hind wing, genitalia above, and clasper.
38. *Diplectrona scabrosa* sp. nov.; genitalia above, clasper.
39. *Hydropsyche rizali* sp. nov.; genitalia, above.
40. *Hydropsychodes normalis* sp. nov.; genitalia, above.
41. *Hydropsyche rizali* sp. nov.; genitalia, side.
42. *Hydropsychodes normalis* sp. nov.; genitalia, side.
43. *Hydropsychodes albocincta* sp. nov.; forewing.

PLATE 5

FIG. 44. *Gœra disparilis* sp. nov.; genitalia, above, below, clasper.
45. *Gœrinella bicolor* sp. nov.; forewing.
46. *Anisocentropus nitidus* sp. nov.; palpus.
47. *Diplectrona fasciata* Ulmer; lower piece from side.
48. *Diplectrona fasciata* var. *stigmatica* var. nov.; lower piece from side, genitalia from above.
49. *Gœrinella apoana* sp. nov.; genitalia, above.
50. *Anisocentropus nitidus* sp. nov.; genitalia, side.
51. *Gœrinella apoana* sp. nov.; forewings of male and of female.
52. *Anisocentropus nitidus* sp. nov.; forewing.
53. *Chimarrha tagalica* sp. nov.; genitalia, side, and forewing in part.
54. *Ecnomus rizali* sp. nov.; genitalia, above.
55. *Chimarrha alticola* sp. nov.; genitalia, below, and side.

PLATE 6

FIG. 56. *Œcetis claggi* sp. nov.; forewing, genitalia, side.
57. *Œcetis separata* sp. nov.; genitalia, side, and forewing.
58. *Œcetis pilosa* sp. nov.; forewing, genitalia, side, and clasper, below.
59. *Œcetis separata* sp. nov.; genitalia, above.
60. *Setodes flavipennis* sp. nov.; genitalia side, penis above.
61. *Allosetodes assimilis* sp. nov.; forewing.
62. *Setodes flavipennis* sp. nov.; superior appendages from above.
63. *Ecnomus rizali* sp. nov.; genitalia, side.
64. *Allosetodes assimilis* sp. nov.; genitalia, side.

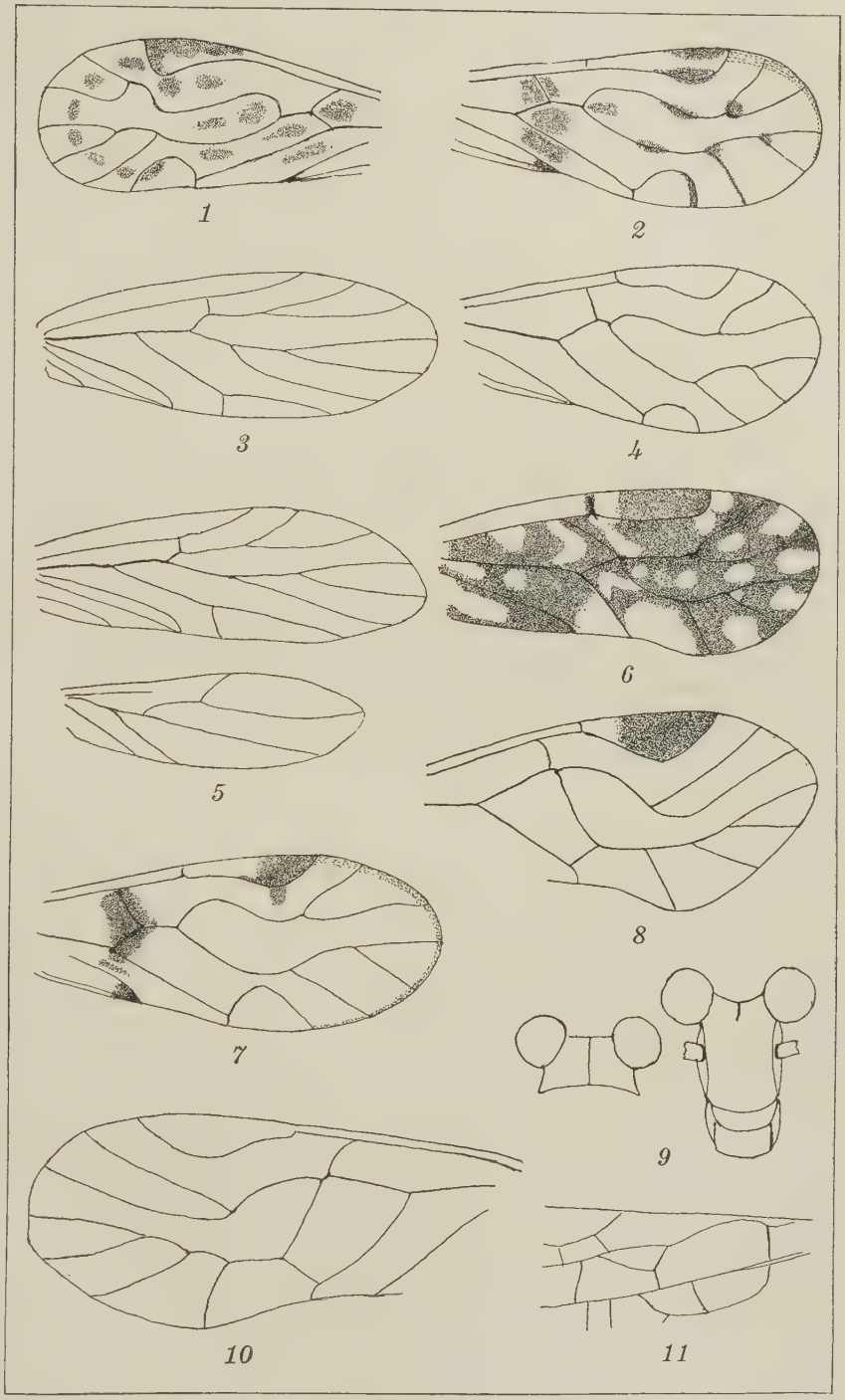

PLATE 1.

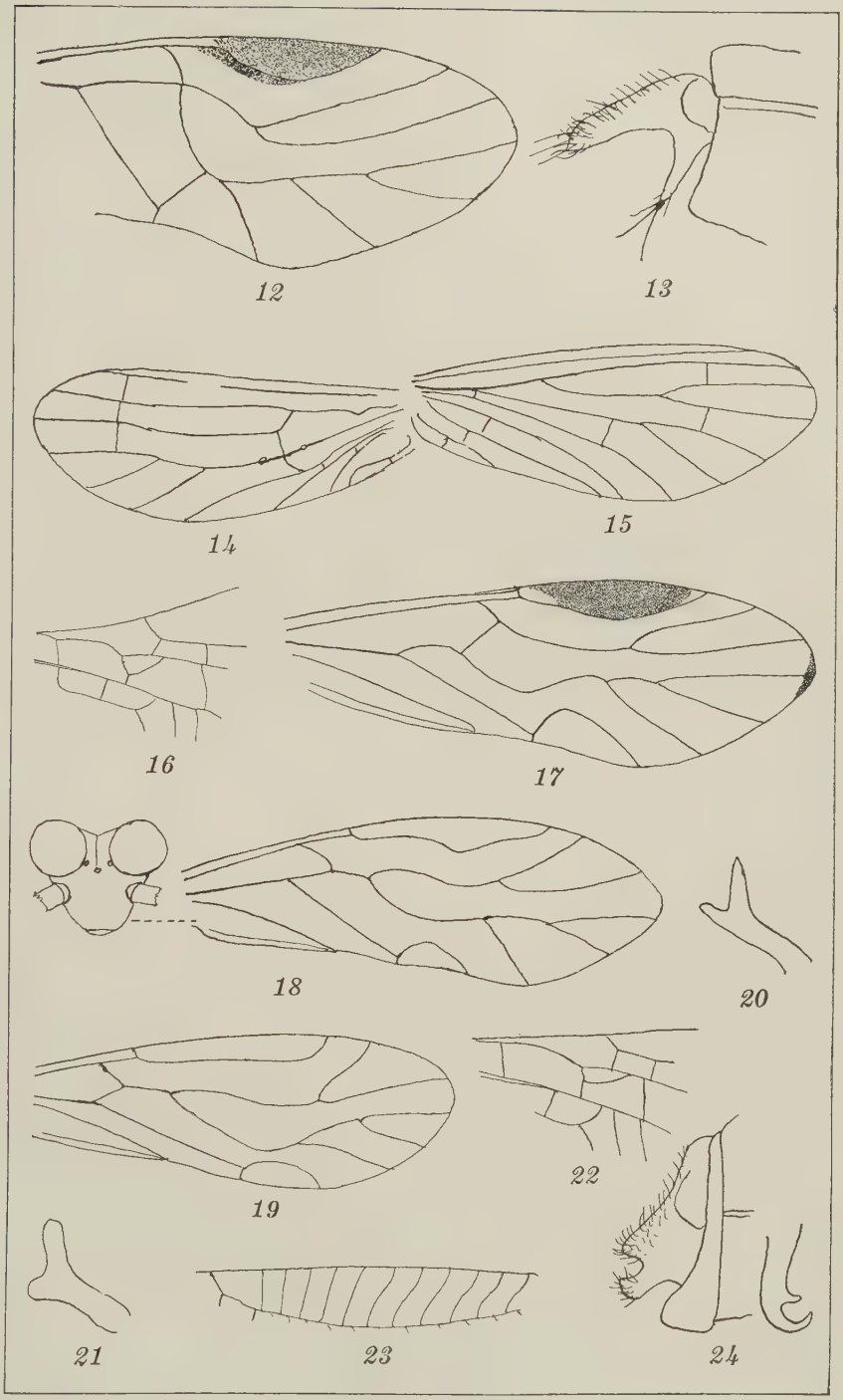

PLATE 2.

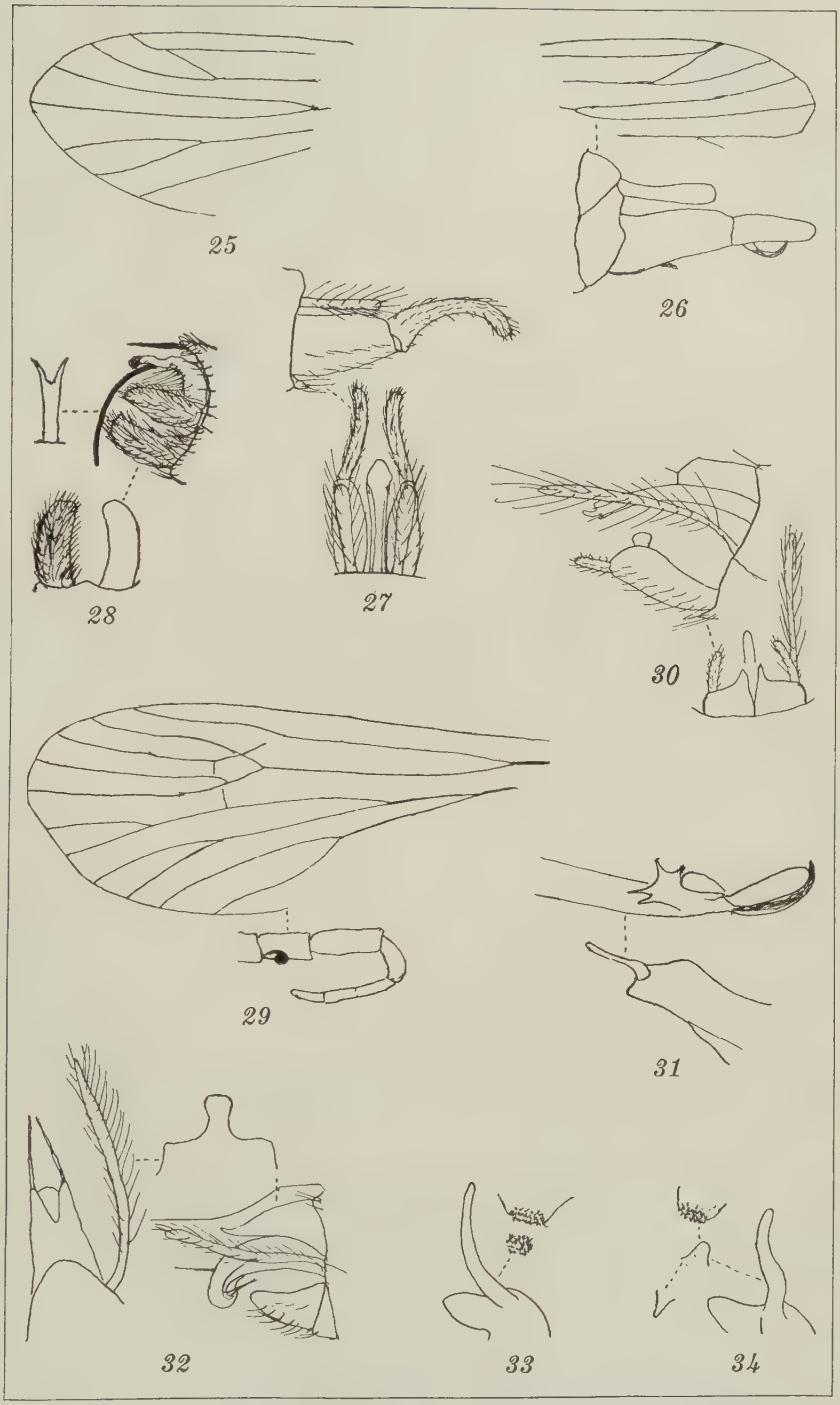

PLATE 3.

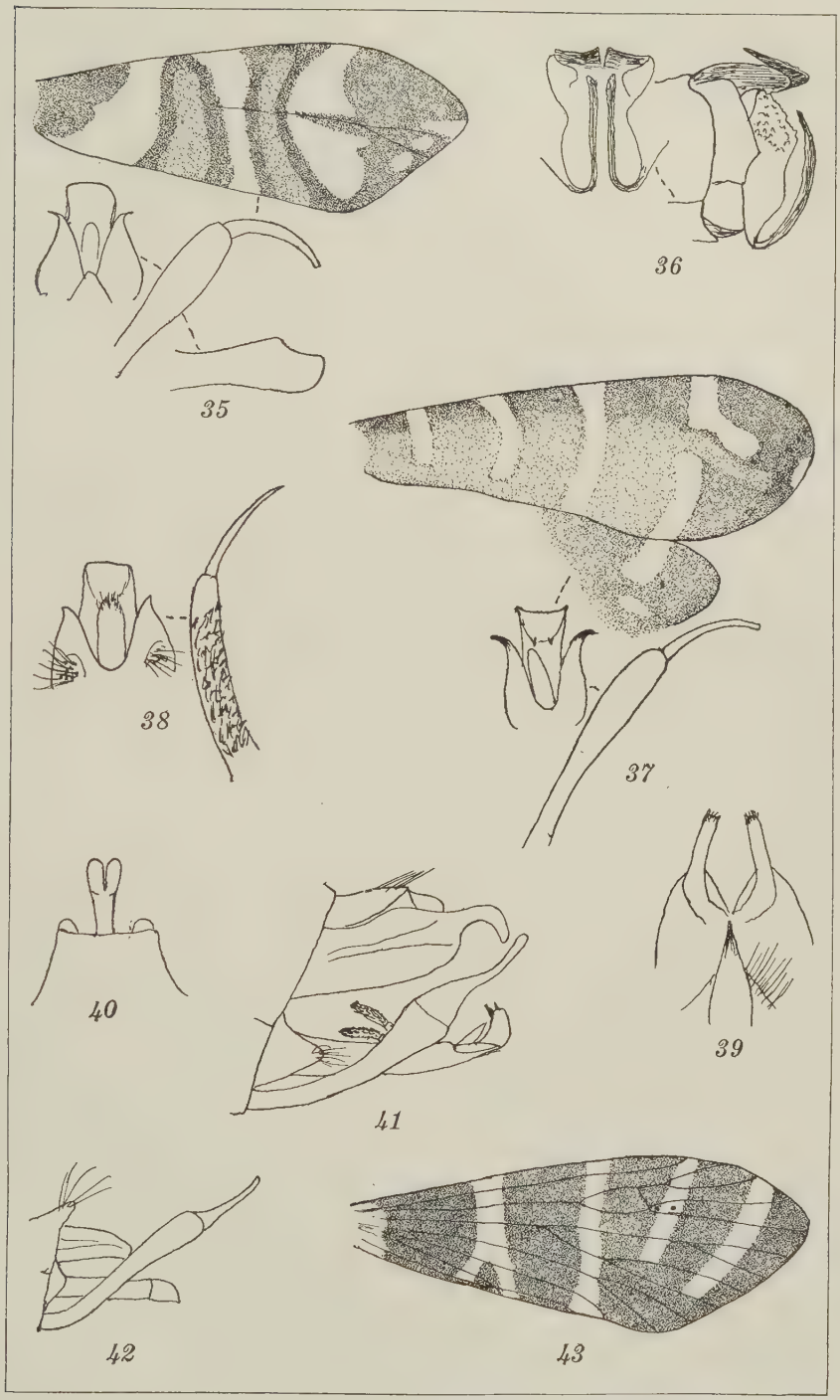

PLATE 4.

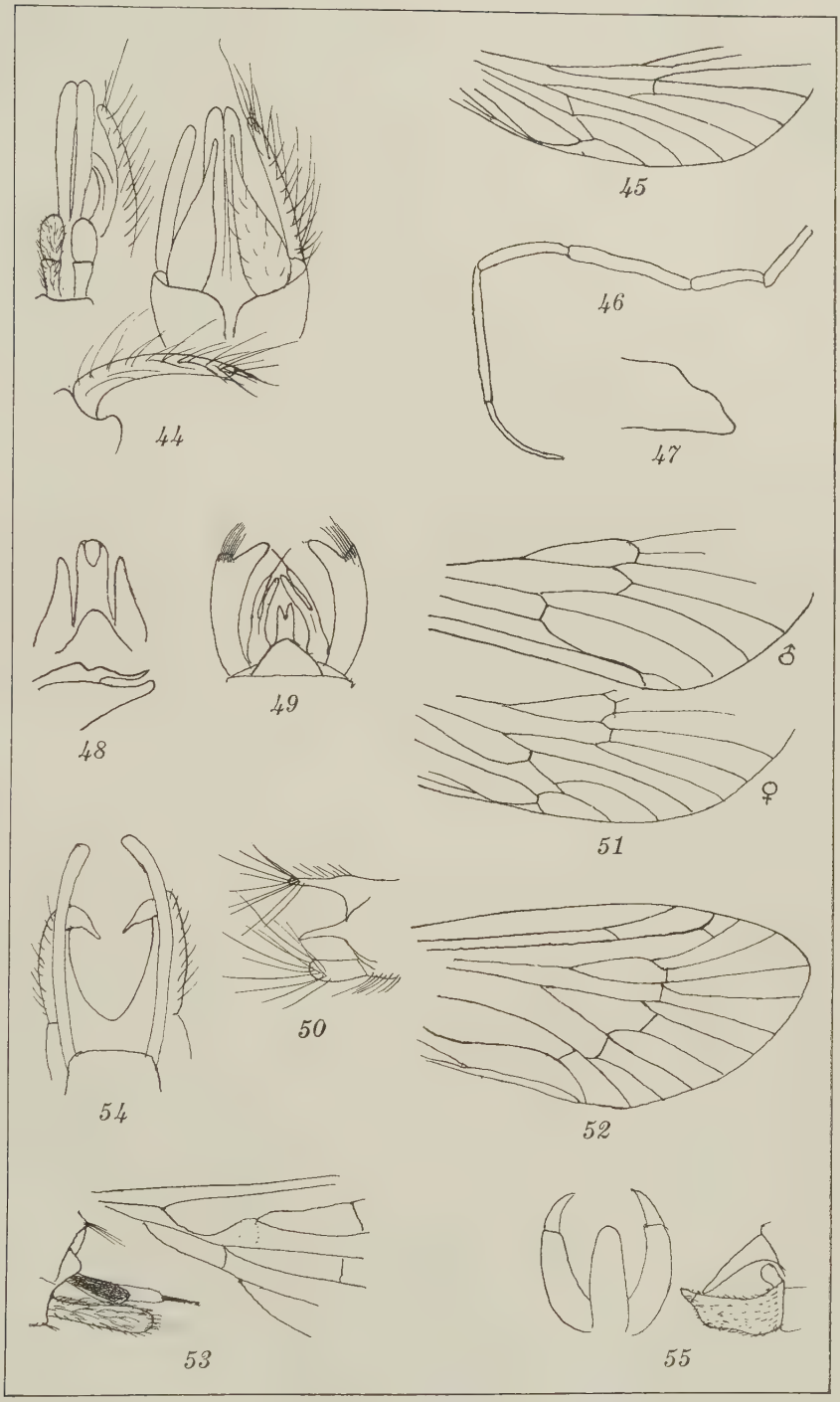

PLATE 5.

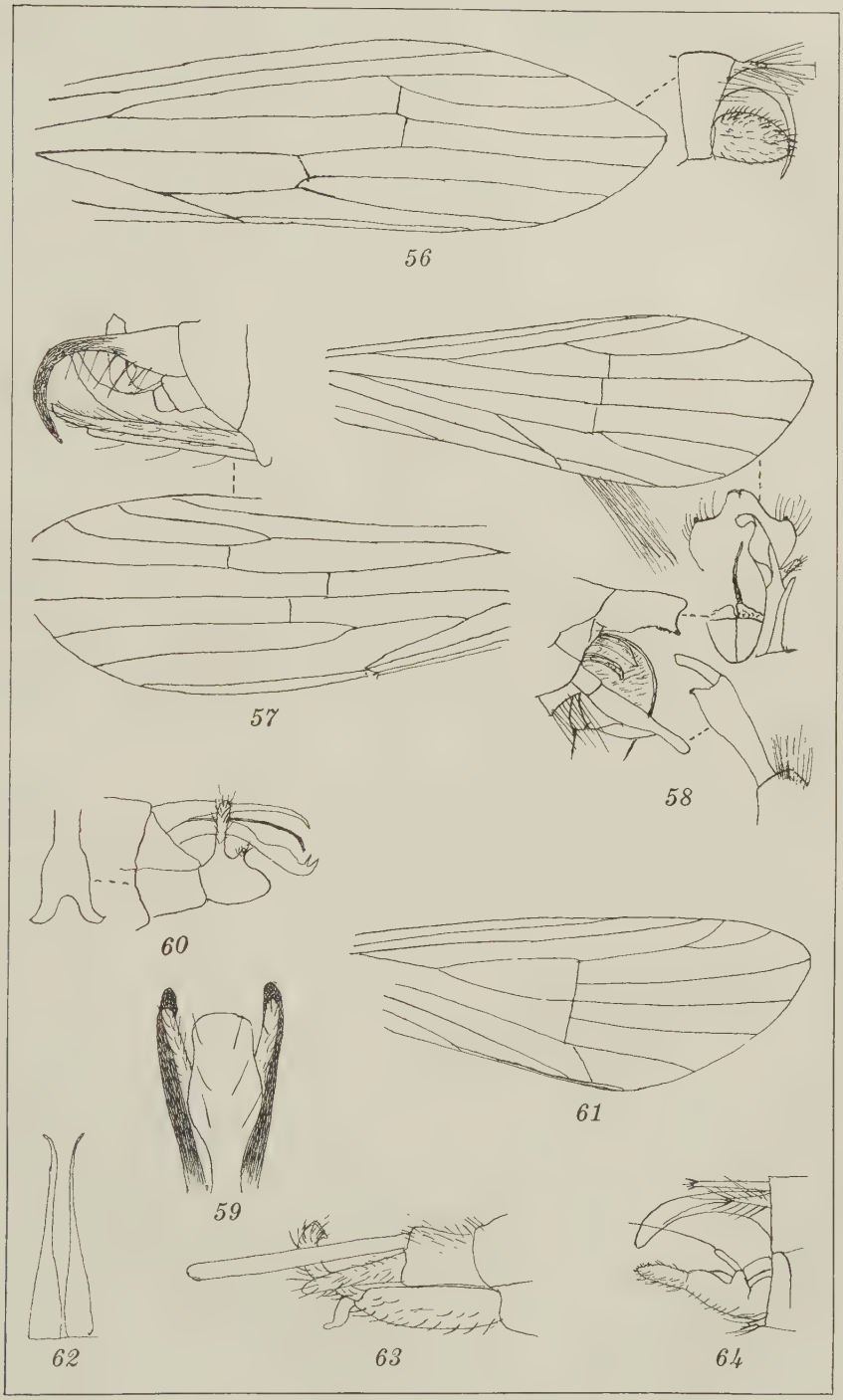

PLATE 6.

A REVIEW OF PHILIPPINE PIGEONS, V

SUBFAMILIES COLUMBINÆ, GEOPELIINÆ, PHABINÆ AND CALŒNADINÆ

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This paper is the continuation of a series the first four parts of which appeared in earlier issues of the Philippine Journal of Science.[1] For convenience, the subfamilies Columbinæ, Geopeliinæ, Phabinæ, and Calœnadinæ are all treated in this paper.

Specimens of *Macropygia phasianella borneensis* were loaned by the Raffles Museum at Singapore, and Silliman University at Dumaguete, Oriental Negros, furnished specimens of *M. p. tenuirostris* from the island of Negros. I am indebted to these institutions for their coöperation. I am also under obligation to Mr. Graciano Castañeda, who placed his small collection of doves and pigeons from several islands at my disposal.

COLUMBINÆ

The subfamily Columbinæ includes pigeons with 12 tail feathers of various lengths; the tarsus and bill slender, the latter with a small gape; nostril covering conspicuously swollen; toes with or without broad soles.

Key to the Philippine genera of Columbinæ.

a^1. Tail even or slightly graduated.
  b^1. Tarsus feathered at base ..... *Columba.*
  b^2. Tarsus not feathered at base.
    c^1. Tail more than 100 mm ..... *Streptopelia.*
    c^2. Tail less than 100 mm ..... *Œnopopelia.*
a^2. Tail greatly graduated ..... *Macropygia.*

Genus COLUMBA Linnæus, 1758

Bill slender; nostril covering greatly swollen, tail even, shorter than wing; tarsus feathered at base.

[1] Philip. Journ. Sci. 59 (1936) 289–305, 327–336; 60 (1936) 157–163, 407–419.

COLUMBA VITIENSIS GRISEOGULARIS (Walden and Layard).

Carpophaga metallica (part.) SCHLEGEL, Ned. Tijds. Dierk. 3 (1866) 202.

Ianthœnas griseogularis WALDEN and LAYARD, Ibis (1872) 104, pl. 6.

Columba griseigularis SALVADORI, Cat. Birds Brit. Mus. 21 (1893) 313.

Janthœnas vitiensis griseogularis HACHISUKA, Birds Philippine Islands 1 pt. 2 (1932) 205.

Basilan, Batan, Cagayan Sulu, Calayan, Guimaras, Lubang, Luzon, Mindanao, Mindoro, Negros, Pula Tiga, Romblon, Sibutu, Sibuyan, Sulu, West Bolod.

Specimens from Batan, Biliran, Cagayan Sulu, Comiran, Lubang, Lumbucan, Luzon, Mindoro, Negros, Panay, and Romblon were examined.

Large pigeons; sexes similar; barbules of inner web of first primary largely decomposed near end; general color slate black with metallic purple or metallic green on head, neck, back, rump, upper tail coverts, breast, abdomen, and under tail coverts. The sheen is due to the iridescent color in the fringes of the feathers in the parts mentioned. Thus the material examined is variable with regards to the sheen. The only specimen examined from the island of Biliran, for example, exhibits a distinctly different sheen, with the head, neck, upper back, breast, and abdomen Deep Livid Brown.[2]

Measurements of Columba vitiensis griseogularis (Layard and Walden) based on thirteen males and six females.

	Extremes. mm.	Mean. mm.
Wing	230–244	235.30
Tail	148–158	153.84
Culmen	21– 23	22.15
Tarsus	28– 29	28.61
Middle toe and claw	41– 45	42.21

Recent studies by Riley (1930) and Rensch (1931) have shown that the Philippine form is subspecifically identical with the one from North Borneo. Moreover, this form, as far as known, represents the northern race of the grey-throated pigeon, *Columba vitiensis* Quoy and Gaimard.

Genus STREPTOPELIA Bonaparte, 1854

Comparatively small with correspondingly small head and small weak bill; neck slender; wing longer than tail; tail longer than 100 mm; feet adapted for walking.

[2] Colors with initial capitals are from R. Ridgway, Color Standards and Color Nomenclature. Washington (1912).

Key to the Philippine species of Streptopelia.

a^1. Feathers of dark band on neck entire; color uniform..... *dussumieri.*
a^2. Feathers of dark band on neck bifurcated; their tips each with a white spot ..... *chinensis.*

STREPTOPELIA DUSSUMIERI (Temminck).

Columba dussumieri TEMMINCK, Pl. Col. livr. 32 (1823) 188.
Turtur dussumieri GRAY, Gen. Birds 2 (1844) 472.
Streptopelia dussumieri BONAPARTE, Compt. Rend. (1855) 219.
Streptopelia dussumieri gutierrezi HACHISUKA, Cont. Birds Philip. No. 2 (1930) 152.

Agutaya, Bantayan, Banton, Basilan, Bohol, Cagayancillo, Calamianes, Calayan, Caluya, Catanduanes, Cebu, Cuyo, Fuga, Guimaras, Leyte, Libagao, Lubang, Luzon, Maestre de Campo, Marinduque, Masbate, Mindanao, Mindoro, Negros, Palawan, Panay, Polillo, Romblon, Samar, Semirara, Siasi, Sibaya, Sibutu, Sibuyan, Siquijor, Sulu, Tablas, Tawitawi, Ticao, Verde.

Specimens from Alabat, Banton, Bohol, Cagayancillo, Calayan, Catanduanes, Cebu, Cuyo, Culion, Fuga, Hermana Mayor, Jintotolo, Lubang, Luzon, Maracañao, Mindanao, Mindoro, Negros, Palawan, Panay, Polillo, Samar, Siasi, Sibuyan, Siquijor and Tablas were examined.

Medium-sized doves; sexes similar; general color of upper parts brown with a light wash of vinous; collar bluish black with a gray wash; chin white, gradually changing into vinous of throat, sides and hind neck and breast; abdomen and under tail coverts white; edges of distal half and outer web of outermost pair of rectrix white.

Measurements of Streptopelia dussumieri (Temminck) based on twenty-nine males and twenty-six females.

	Extremes. mm.	Mean. mm.
Wing	153–164	158.68
Tail	125–145	129.21
Culmen	15– 16	15.85
Tarsus	26– 29	27.71
Middle toe and claw	28– 32	30.00

The large series of specimens studied from different islands confirms the contention of many previous workers that only one race exists in the Philippines.

STREPTOPELIA CHINENSIS PALAWANA Hachisuka.

Turtur tigrina SHARPE, Ibis (1888) 203.
Spilopelia tigrina MCGREGOR and WORCESTER, Hand-list Bds. Philip. Is. (1906) 14.
Streptopelia chinensis palawana HACHISUKA, Birds Philippine Is. 1 pt. 2 (1932) 212.

Balabac, Palawan.

Specimens from Busuanga and Palawan were examined.

Medium-sized dove; sexes similar. The gray, vinous-washed head is separated from the brown, black-striped, fulvous-tipped back and the rest of the upper parts by a black collar, the feathers of which are bifurcate with white tips. Under parts largely vinaceous-pink, gradually changing into buffish white of abdomen, vent, and under tail coverts.

Measurements of Streptopelia chinensis palawana Hachisuka based on seven males and seven females.

	Extremes. mm.	Mean. mm.
Wing	135–141	137.87
Tail	136–143	139.33
Culmen	15– 16	15.56
Tarsus	24– 25	24.8
Middle toe and claw	27– 28	27.3

For a long time this bird had been referred to *Spilopelia tigrina*, a species peculiar to the Malay Peninsula, Java, Sumatra, Borneo, and adjoining islands. Hachisuka (1932) in separating the present form indicated its smaller size than that of *Spilopelia chinensis tigrina*. In the present study the Palawan form was not compared with those from other places, but the writer is inclined to accept the separation of *Streptopelia chinensis palawana* from *Streptopelia chinensis tigrina*, as according to Stuart Baker (1928) the wing of *S. chinensis tigrina* measures 137 to 155 mm while Robinson and Chasen (1936) give 5.75 inches (146 mm).

Genus ŒNOPOPELIA Blanford, 1898

Comparatively small dove; sexes dissimilar, first primary almost equal to the second; tail short, less than 100 mm long.

ŒNOPOPELIA TRANQUEBARICA HUMILIS (Temminck).

Columba humilis TEMMINCK, Pl. Col. livr. 44 (1824) 259.
Streptopelia humilis BONAPARTE, Comp. Rend. 40 (1855) 18, 219.
Turtur humilis WALDEN, Trans. Zoöl. Soc. London 9 pt. 2 (1875) 219.
Onopopelia humilis SHARPE, Hand-list Birds Brit. Mus. 1 (1899) 79.
Œnopopelia tranquebarica humilis HACHISUKA, Contrib. Bds. Philip. No. 2 (1930) 152.

Calayan, Lubang, Luzon, Mindoro.

Specimens from Luzon were examined.

Male.—Upper parts darker vinaceous red than under parts; head, lower back, rump and upper tail coverts gray; narrow nuchal band black.

Female.—General color much lighter than male.

Measurements of Œnopopelia tranquebarica humilis (Temminck) based on ten males and three females.

	Extremes. mm.	Mean. mm.
Wing	130–141	134.8
Tail	85– 89	86.36
Culmen	14– 15	14.16
Tarsus	.....	21.0
Middle toe and claw	23– 25	23.83

The present race is identical with that of southern Asia. This subspecies is abundant in certain parts of Luzon and has been recorded in a few neighboring islands.

Genus MACROPYGIA Swainson, 1837

Tail greatly graduated, longer than wing; tarsus feathered at base, toes long and slender with broad soles.

McGregor (1909) recorded two species in the Philippines. Hachisuka (1932) listed three subspecies of only one species. It appears, however, that *Macropygia phasianella septentrionalis* Hachisuka (1930) should not, if valid, be included in the Philippine list. Batan and Botel Tobago were given as localities for this subspecies. The present study shows that specimens of the cuckoo dove from Batan are identical with those from Calayan described earlier by McGregor as *M. phasianella phæa.* Botel Tobago is not politically a part of the Philippine Archipelago. No specimen from this locality has been examined.

In view of their close resemblance the two Philippine races have been relegated to one species.

MACROPYGIA PHASIANELLA TENUIROSTRIS Bonaparte.

Columba phasianella TEMMINCK, Trans. Linn. Soc. 13 (1821) 129.
Macropygia tenuirostris BONAPARTE, Consp. Gen. Avium 2 (1854) 57.
Macropygia eurycerca TWEEDDALE, Proc. Zool. Soc. London (1875) 218.
Macropygia tenuirostris tenuirostris HACHISUKA, Cont. Bds. Philip. No. 2 (1930) 151.
Macropygia phasianella tenuirostris HACHISUKA, Bds. Philip. Is. 1 pt. 2 (1932) 207.

Balabac, Basilan, Bohol, Bungau, Leyte, Luzon, Marinduque, Masbate, Mindanao, Mindoro, Negros, Palawan, Polillo, Romblon, Sibutu, Sibuyan, Sulu, and Tawitawi.

Specimens from Basilan, Bohol, Busuanga, Leyte, Luzon, Mindanao, Mindoro, Negros, Palawan, Polillo, and Samar were examined.

Male.—Upper parts dark brown with a shade of rufous, tips of feathers dotted with cinnamon rufous appearing in the form

of vermiculation; head and underparts cinnamon rufous; neck and sides with amethystine and green gloss.

Female.—Similar to the male, but neck and its sides dark brown barred with buff; throat and breast barred with dark brown.

Measurements of Macropygia phasianella tenuirostris Bonaparte based on fifteen males and seventeen females.

	Extremes. mm.	Mean. mm.
Wing	165–186	172.9
Tail	180–208	185.06
Culmen	15– 17	15.25
Tarsus	21– 22	22.38
Middle toe and claw	31– 35	33.05

Walden (1878) gave *Macropygia eurycerca* as a new name for the cuckoo dove from Negros, after verifying the distinction between the birds of Negros and those from Luzon which he first noted in an earlier publication (1875). Sharpe (1877), using the characters mentioned by Tweeddale (1875),[3] found no difference between the birds from Basilan, Negros, and Luzon. In a later paper Sharpe (1879) concurred with the view of Professor Schlegel in that *M. tenuirostris* "is found all over the Philippines and occurs even in Borneo." He thus reiterated his view that *M. eurycerca* is not a valid species. While the Bornean form has been given a subspecific status by Robinson and Kloss (1921), who regarded it as conspecific with the Philippine form, the Negros, Mindanao, and Basilan cuckoo dove seems to have remained identical with the Luzon form, according to subsequent authors. In the present study all cuckoo doves studied from the different islands except those from northern Luzon (*M. p. phæa*) are regarded as belonging to *M. p. tenuirostris.*

MACROPYGIA PHASIANELLA PHÆA McGregor.

Macropygia phæa McGregor, Bull. Philip. Mus. 4 (1904) 9.

Macropygia tenuirostris phæa Hachisuka, Cont. Bds. Philip. No. 2 (1930) 151.

Macropygia phasianella phæa Hachisuka, Bds. Philip. Is. 1 pt. 2 (1932) 208.

Batan, Calayan.

Specimens from these islands were examined.

Similar to *M. phasianella tenuirostris* but larger and darker.

[3] Marquis of Tweeddale; same as Viscount Walden.

Measurements of Macropygia phasianella phæa McGregor based on two males and three females.

	Extremes. mm.	Mean. mm.
Wing	196–202	199.0
Tail	192–201	197.0
Culmen	.....	17.0
Tarsus	25–26	25.6
Middle toe and claw	36–37	36.4

The birds from Batan and Calayan are identical. The Batan birds should, therefore, retain the name *M. phasianella phæa* McGregor (1904) and not be included in *M. phasianella septentrionalis* Hachisuka (1930). If the latter name is valid it should not be included in the Philippine list.

GEOPELIINÆ

This subfamily is represented in the Philippines by only one race.

GEOPELIA STRIATA STRIATA (Linnæus).

Columba striata LINNÆUS, Syst. Nat. 12th ed. (1766) 282.
Geopelia striata WALDEN, Trans. Zoöl. Soc. London 9 pt. 2 (1875) 223.

Lubang, Luzon, Mindoro, Verde.

Specimens from Lubang, Luzon, and Mindoro were examined.

Comparatively small dove. Sexes similar; tail with 14 feathers graduated, longer than wing. Upper parts largely brown, feathers with dark fringe forming distinct bars; chin and throat pearl gray; middle of breast vinaceous pink gradually changing to white of under tail coverts, dark bars on white feathers of sides and flanks very conspicuous.

Measurements of Geopelia striata striata Linnæus based on thirty-seven males and thirty-three females.

	Extremes. mm.	Mean. mm.
Wing	96–103	98.52
Tail	97–117	106.14
Culmen	12– 13	12.78
Tarsus	17– 19	17.64
Middle toe and claw	21– 24	21.93

The distribution of this dove is very interesting. It is abundant in north and central Luzon, but rare in the southern part of the island. In Verde, Lubang, and Mindoro it is rare and it has not been recorded in Catanduanes. It is recorded in Borneo, Sumatra, Java, and Malay Peninsula, according to Chasen

(1935), but has not been reported in the islands intervening between Luzon and Borneo, where it would be expected to occur.

PHABINÆ

One race is recorded in the Philippines.

CHALCOPHAPS INDICA INDICA Linnæus.

Columba indica LINNÆUS, Syst. Nat. 10th ed. 1 (1758) 164.
Columba pileata SCOPOLI, "Del. Flor. et Faun. Insular." pt. 2 (1786) 94 (Ex Sonnerat).
Columba albicapilla GMELIN, "Syst. Nat." 1 (1788) 775 (Ex Sonnerat).
Chalcophaps indica WALDEN, Trans. Zoöl. Soc. London 9 pt. 2 (1875) 221.

Banton, Basilan, Batan, Bohol, Cagayancillo, Calamianes, Calayan, Camiguin Norte, Cebu, Cuyo, Fuga, Guimaras, Lubang, Luzon, Marinduque, Masbate, Mindanao, Mindoro, Negros, Palawan, Panay, Polillo, Romblon, Samar, Sibuyan, Siquijor, Sulu, Tablas, Tawitawi, Ticao, Verde.

Specimens from Alabat, Banton, Basilan, Batan, Bohol, Cagayancillo, Cagayan Sulu, Cebu, Cuyo, Divinubo, Fuga, Luzon, Masbate, Mindanao, Negros, Palawan, Polillo, Romblon, Samar, and Siquijor were examined.

Medium-sized pigeons; sexes dissimilar; tail with 12 feathers, rounded, shorter than wing.

General color, metallic emerald-green and brown above; brown below.

Male.—Forehead to superciliary stripe white, changing to bluish gray of crown and nape; neck and shoulders Carob Brown, this color extending below through sides of head and neck to the breast; back scapulars, wing coverts, and inner secondaries metallic emerald-green with metallic gloss; rump dark brown with metallic green gloss; tail coverts slate gray, similar to upper tail coverts; lower breast, abdomen, and flanks Hair Brown.

Female.—White of forehead and superciliary less distinct. Crown, nape, and neck Hair Brown like underparts; upper tail coverts and upper surface of tail brown with slight tinge of olivaceous gloss. In other parts similar to the male.

Measurements of Chalcophaps indica indica (Linnæus) based on eighteen males and twenty females.

	Extremes. mm.	Mean. mm.
Wing	141–151	143.52
Tail	80– 93	89.97
Culmen	16– 17	16.61
Tarsus	26– 28	26.87
Middle toe and claw	26– 30	28.81

A bird of the woods. Widely distributed over the Archipelago though not very common.

CALŒNADINÆ

One race is known in the Philippines.

CALŒNAS NICOBARICA NICOBARICA (Linnæus).

Calœnas nicobarica CASSIN, U. S. Explor. Exped. (1858) 276.

Balabac, Mindanao, Mindoro, Negros, Palawan, Sibutu, Siquijor, Sulu, Talaran (off Basilan), Tawitawi, Ursula.

Specimens from Cavilli, Lumbucan, Mindanao, Siquijor, and Ursula were examined.

Comparatively large-sized terrestrial pigeons; sexes similar in general appearance, tail rounded with 12 feathers less than half length of wing; neck feathers much more slender than others, loosely set, and forming an ornamentlike hackle.

General color of male deep metallic bluish black with sheen of various bluish green shades; tail largely white. Females have duller colors.

Measurements of Calœnas nicobarica nicobarica (Linnæus) based on five males and five females.

	Extremes. mm.	Mean. mm.
Wing	241–257	246.66
Tail	87– 93	88.50
Culmen from nostril	15– 16	15.16
Tarsus	39– 45	42.83
Middle toe and claw	43–48	45.83

The race appears to be commoner in the southern islands than in the more northern limits of its distribution.

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THE AVIFAUNA OF CATANDUANES

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John Whitehead visited Catanduanes in September, 1894. The results of his ornithological collection and observations there were published by Grant (1895). Collecting on this island for about one month, Whitehead obtained forty-eight species of birds. No further collecting had been done when this paucity of information about the avifauna of this island caused the writer to undertake the study reported in this paper.

According to the United States Coast Pilot (1927) Catanduanes Island is about 35 miles (56.3 kilometers) long, from north to south, and about 23 miles (37 kilometers) wide. It is mountainous and lies within 124° 10′ and 124° 25′ east longitude and 13° 30′ and 14° 10′ north latitude. Faustino (1927) states that it has an area of 1,461 square kilometers. This island is separated from the mainland of Luzon through Caramoan Peninsula, by the Maqueda Channel. The southern entrance of the channel, which is its narrowest part, is, according to U. S. Coast Pilot (1927), about four miles (6.4 kilometers) wide and about 44 fathoms deep.

From existing geological evidence Dickerson and others (1928) believe that Catanduanes, together with some other islands, was possibly connected with southern Luzon during the Pleistocene period. Faunistic studies like the present should help greatly in tracing the island's geologic history.

The data here presented were obtained by the writer, accompanied by Francisco S. Rivera, in a field trip to the island of Catanduanes, from December 3 to December 12, 1936.

The 140 birds, belonging to 60 forms, collected on this trip are listed in a later paragraph.

The terrific typhoon of December 2, 1936, which caused the destruction and denudation of considerable amounts of forest land, perhaps caused the apparent scarcity of bird life in the island at the time of collecting. Collecting was done principally in the vicinity of Bato and Virac in the southern part of the island.

The nomenclature adapted in this paper is taken from the following sources: Peters, J. L., "Birds of the World" 2 volumes; Hachisuka, M., "Birds of the Philippine Islands" 4 parts; Kuroda, N., "Birds of the Island of Java" 2 volumes; Chasen, F. N., "A Handlist of Malaysian Birds"; McGregor, R. C., "A Manual of Philippine Birds."

BIRDS COLLECTED IN CATANDUANES [1]

Scientific name.	Common name.
Excalfactoria chinensis lineata (Scopoli).	Island painted quail.
Streptopelia dussumieri (Temminck).*	Dussumier's turtle dove.
Rallus torquatus torquatus Linnæus.*	Philippine rail.
Pluvialis dominica fulva (Gmelin).	Asiatic golden plover.
Charadrius dubius dubius Scopoli.*	Little ringed plover.
Capella megala (Swinhoe).	Swinhoe's snipe.
Egretta garzetta nigripes (Temminck).	Little white egret.
Butorides striatus javanicus (Horsfield).	Javan green heron.
Accipiter virgatus gularis (Temminck and Schlegel).	Japanese sparrow hawk.
Spilornis holospilus holospilus (Vigors).*	Philippine serpent eagle.
Butastur indicus (Gmelin).	Tic-wee buzzard.
Pernis apivorus ptilorhyncus (Temminck).	Crested honey buzzard.
Prioniturus discurus discurus (Vieillot).*	Philippine racket-tailed parakeet.
Loriculus philippinensis philippensis (P. L. S. Müller).*	Luzon hanging parakeet.
Eurystomus orientalis orientalis (Linnæus).	Broad-billed roller.
Halcyon smyrnensis gularis (Kuhl).	White-throated kingfisher.
Penelopides panini manillæ (Boddaert).	Luzon tarictic.
Collocalia whiteheadi whiteheadi Grant.	Whitehead's swiflet.
Collocalia troglodytes Gray.	Pygmy swiflet.
Hierococcyx fugax hyperythrus (Gould).	Sino-Malayan hawk cuckoo.
Lepidogrammus cumingi (Fraser).	Scale-feathered cuckoo.
Centropus viridis (Scopoli).*	Red-winged coucal.
Dasylophus superciliosus (Cuvier).*	Rough-crested cuckoo.

[1] An asterisk * after the name of a bird indicates a previous record by Whitehead.

BIRDS COLLECTED IN CATANDUANES—continued

Scientific name.	Common name.
Hirundo tahitica javanica Sparrman.*	Asiatic swallow.
Hemichelidon griseisticta griseisticta Swinhoe.	Gray-spotted flycatcher.
Hypothymis azurea azurea Grant and Whitehead.	Black-naped flycatcher.
Xeocephus rufus rufus (Gray).	Long-tailed flycatcher.
Coracina striata striata (Boddaert).	Luzon cuckoo-shrike.
Lalage nigra chilensis (Meyen).*	Pied lalage.
Iole philippensis philippensis (Gmelin).	Philippine bulbul.
Euptilosus urostictus urostictus (Salvadori).*	Wattled bulbul.
Pycnonotus goiavier goiavier (Scopoli).	Guava bulbul.
Calliope calliope calliope (Pallas).	Siberian rubythroat.
Locustella ochotensis ochotensis (Middendorf).	Yellow grasshopper warbler.
Orthotomus derbianus Moore.*	Derby's tailorbird.
Cisticola cisticola cisticola (Temminck).	Rufus grass warbler.
Megalurus palustris forbesi Bangs.*	Striated marsh warbler.
Phylloscopus borealis borealis (Blasius).	Northern willow warbler.
Artamus leucorynchus leucorynchus (Linnæus).*	White-bellied swallow shrike.
Lanius cristatus lucionensis (Linnæus).*	Red-tailed shrike.
Parus elegans Lesson.	Elegant titmouse.
Zosterops aureiloris Grant.	Golden-lored silvereye.
Dicæum papuense (Gmelin).	Philippine flowerpecker.
Dicæum obscurum Grant.	Dusky flowerpecker.
Prionochilus inexpectatus Hartert.	Hartert's flowerpecker.
Prionochilus parsonsi McGregor.	Parson's flowerpecker.
Piprisoma æruginosum (Bourns and Worcester).	Rusty flowerpecker.
Leptocoma braziliana sperata (Linn.).	Red-breasted sunbird.
Leptocoma flagrans (Oustalet).*	Flaming sunbird.
Leptocoma jugularis jugularis (Linn.).*	Yellow-breasted sunbird.
Anthreptes malacensis griseigularis Tweeddale.	Gray-throated sunbird.
Motacilla flava simillana Hartert.*	Siberian yellow wagtail.
Anthus hodgsoni Richmond.	Spotted tree pipit.
Anthus richardi lugubris Walden.	Indian pipit.
Munia atricapilla minuta (Meyen).*	Philippine weaver.

BIRDS COLLECTED IN CATANDUANES—continued

Scientific name.	Common name.
Uroloncha leucogastra everetti (Tweeddale).*	Everett's weaver.
Oriolus chinensis chinensis Linnæus.*	Philippine oriole.
Dicrurus hottentottus balicassius (Linn.).	Northern drongo.
Sarcops calvus (Linn.).*	Gray-backed bald starling.
Corvus coronoides philippinus Bonaparte.*	Philippine crow.

The following birds were noted but not collected:

Macropygia phasianella tenuirostris Bonaparte.	Slender-billed cuckoo dove.
Haliastur indus intermedius Blyth.*	Malayan brahminy kite.
Kokatoe hæmaturopygius hæmaturopygius (P. L. S. Müller).	Philippine cockatoo.
Alcedo atthis bengalensis Gmelin.*	Asiatic kingfisher.
Pitta erythrogastra Temminck.	Red-breasted ant thrush.
Rhipidura javanica nigritorquis Vigors.*	Black and white fantail-flycatcher.
Rhipidura cyaniceps cyaniceps (Cassin).	Rufus-bellied fantail-flycatcher.
Passer montanus saturatus Stejneger.	Oriental tree sparrow.

Of the 60 forms of birds we obtained from Catanduanes 23 were recorded previously by Whitehead. Considering Whitehead's and our collection together, 85 forms will have been recorded from the avifauna of Catanduanes, including 14 migratory species. The 85 forms collected by Whitehead and by us are also found in Luzon. The 8 forms that were noted but not collected have also been recorded in Luzon. Moreover, 12 of those collected and one of those merely seen are distinctly Luzon forms. The writer was informed of the presence of a bleeding-heart pigeon, *Gallicolumba* sp., in Catanduanes, and according to description it is *G. luzonica*.

This similarity of the avifauna of the two islands is attributed primarily to their closeness; only an area of approximately 6.4 kilometers separates them. The possibility, however, of the species having been isolated in times too recent for any modification can be conjectured. The depth of the channel (44 fathoms) positively indicates a recent separation of Catanduanes from Luzon.

CONCLUSION

The avifauna of the island of Catanduanes, according to the results so far obtained, is distinctly similar to that of Luzon. This similarity is accounted for primarily by the fact that they are separated by a very narrow channel.

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THE FISHERIES OF LAKE TAAL, PANSIPIT RIVER, AND BALAYAN BAY, BATANGAS PROVINCE, LUZON

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FOUR PLATES AND TWO TEXT FIGURES

LAKE TAAL

Lake Taal, or Lake Bombon, Batangas Province, Luzon, has an area of approximately 267 square kilometers. Its depth varies from that of shallow water to 200 meters. Apart from its beautiful surroundings and the presence at its center of one of the lowest volcanoes in the world, it is famous also for its fisheries, which are known to contain the choicest food fishes in sufficient abundance to be of commercial significance.

In this paper the fishery industries of Lake Taal and Pansipit River are discussed primarily from the point of view of their conservation and the means of protecting the larvæ, fry, and young of the migratory species that constitute the bulk of these fisheries. Suggestions and recommendations to attain this end are given and discussed at some length. The fisheries of Balayan Bay are discussed with special consideration of their relation to the conservation of the fisheries of Lake Taal and Pansipit River. The seasonal occurrence of the commercial fishes of Balayan Bay and methods of fishing are also discussed.

Small streams enter Lake Taal, but its outlet is Pansipit River, which empties into Balayan Bay of the China Sea. This river has a flow of considerable volume, although it is approximately only 8 kilometers long, and not sufficiently deep to be navigated by boats with draft of more than 7 feet.

BALAYAN BAY

Balayan Bay is formed by the extension of Calatagan and Bauan Peninsulas from the mainland of Batangas into the China Sea. It is partly protected from high winds by the islands of Mindoro and the Lubang group. Between Balayan Bay and the mainland of Mindoro is the Verde Island Passage which permits the rich marine fauna of the China Sea to enter Balayan Bay.

Commercial value.—On the basis of figures of catch and sale over many years compiled from the records of the various lease holders, the value of the fisheries of Lake Taal and Pansipit River may be easily placed at no less than 500,000 pesos a year.

Kinds of fish composing the fisheries of Lake Taal.—Various investigators, collectors, and students of fishes have so far recorded the existence of forty-seven species of fish in Lake Taal and Pansipit River. Only eight of these are of commercial value. They are here listed somewhat in the order of their importance: (1) *Muslo, Caranx marginatus* Gill; (2) *maliputo, Caranx ignobilis* (Forskål); (3) *manipis, Caranx* sp.; (4) *lumulukso, Chanos chanos* (Forskål); (5) *alsó, Lutianus argentimaculatus* (Forskål); (6) *tawilis, Harengula tawilis* Herre; (7) *buan-buan, Megalops cyprinoides* (Broussonet); (8) *banak, Mugil* spp. These eight species of fishes constitute the bulk of commercial catches in Lake Taal and Pansipit River. The ten species constituting the less important food fishes in Lake Taal and Pansipit River are: (1) *Igat* or *palos, Anguilla mauritiana* Bennett; (2) *biyá, Glossogobius giurus* (Buchanan-Hamilton); (3) *dalag, Ophicephalus striatus* Bloch; (4) *kitang, Scatophagus argus* (Boddaert); (5) *asohos, Sillago sihama* (Forskål); (6) *baculihan* or *dalagan, bañgayñgay* or *palauan, Ophiocara aporos* Bleeker; (7) *bagaong, Therapon jarbua* (Forskål); (8) *damagan, Kuhlia rupestris* Lacépède or *Kuhlia marginata* Cuvier and Valenciennes; (9) *katabá, Toxotes jaculator* (Pallas); (10) *dañgat* or *lañgaray, Ambassis* spp.

Other species found in Lake Taal and Pansipit River are small fishes not utilized for food and therefore not economically important, except as the primary source of food for large, economic species.

Two kinds of crustaceans enter in the commercial fisheries of Lake Taal and Pansipit River, the *katang* or *talangka,* small fresh-water crabs belonging to the family Grapsidæ, and the *apta,* small prawns or fresh-water shrimps of the family Atyidæ. The katang or talanka are boiled and eaten or triturated with salt and made into *patis.* The apta are boiled fresh and eaten, or sun-dried and prepared for both human and poultry consumption. They are also preserved in salt and subsequently fermented into a native preparation, called *alamang.*

Pansipit River, from its mouth to about 2 kilometers above it, harbors in abundance a species of bivalves, locally called *parros, Solotellina elongata* (Lamarck). These mussels are gathered almost every day and sold in the local markets. It is estimated that no less than 50 pesos' worth of these bivalves are gathered every day during at least three months a year from Pansipit River. They are especially in demand during inclement weather when fishing is not possible in the open waters.

Methods of fishing and the migratory habits of fishes.—The methods of fishing and the migratory habits of fishes have an important bearing on the problems of conservation and depletion of fisheries. Most of the valuable and commercial fishes constituting the bulk of these fisheries are migratory. The larvæ or fry and the fingerlings ascend Pansipit River from Balayan Bay to enter Lake Taal, where they stay until they attain sexual maturity or marketable size. When about ready to live in the salt water the fish descend the river. In this way wholesale capture of both the young and the adults is rendered very easy, as catching devices are set in Pansipit River through which the fish migrating in compact groups or shoals must pass on their seaward and lakeward movements. Thus the famous muslo, maliputo, manipis (Carangidæ), the large lumulukso (bañgos, *Chanos chanos*), the banak (mullets, Mugilidæ), the buan-buan (tarpons, Megalopidæ), the kitang (butter or spade fish, Scatophagidæ), the igat or palos (eels, Anguillidæ), the alsó (gray snappers, Lutjanidæ), the maya-maya (red snapper, Lutjanidæ), and other fishes of similar migratory habits, are caught in large numbers now and then in the Baklad-Pansipit (fish corrals placed across Pansipit River), the Baklad Bokana (fish corrals placed in Lake Taal not far from the source of Pansipit River), and the Baklad Wawa (fish corrals placed in Balayan Bay not far from the mouth of Pansipit River). Similarly, these fishes are caught in large numbers in nets (salambao, sakag, etc.) operated in the waters mentioned. Even the talanká or katang (freshwater crabs) which have similar migratory habits are captured in large numbers in Pansipit River when they make the seaward migration to spawn in the salt water.

From the point of view of conservation of the supply, this habit of the fish and of the katang is unfortunate, since the continuous destruction in large numbers of the breeders and

the young prevents the replacement of individuals necessary to keep the species at normal numbers.

The destruction of larvæ, fry, and young of these migratory fishes of Lake Taal and Pansipit River is aggravated by two circumstances: (1) The use of very fine-meshed nets from March to June in and in the vicinity of the mouth of Pansipit River for the primary purpose of catching bañgos fry, and (2) the eruption of Taal Volcano in 1911. Unfortunately, with regard to the former, during this time of year fry of other migratory fishes are also found in abundance in Balayan Bay and at the mouth of Pansipit River. These are, therefore, taken also in nets used in the catching of bañgos fry. Moreover, only the bañgos fry are taken, while the fry of other species are wantonly thrown on the beach to die. One of the consequences of the eruption of Taal Volcano was the sinking of land and the subsequent formation of tidal streams and swamps in the vicinity of Lemery, Batangas, covering an area of about 50 hectares.

These tidal streams provided a connection between a portion of Pansipit River and of Balayan Bay at Sukol, Lemery. In this way the larvæ and fry of migratory fishes are enabled to reach Pansipit River, whence they pass into Lake Taal, as well as by way of the tidal streams (now known as the Palanas of Lemery). The latter route of the larval fishes in their lakeward migration has several advantages over the former; namely, the larvæ and fry have a better chance to develop into larger and hardier individuals before they reach the fresh and swift-flowing stream of Pansipit River. From Balayan Bay to Pansipit River the tidal waters change gradually in salinity and pH, hence the delicate fry undergo gradual changes, from a salt- to a fresh-water habitat. The tidal streams are sheltered from untoward weather changes, and the characteristic food of the fry and larvæ of fishes is more abundant in these waters. Predatory fishes that devour fry and larval fishes are found in smaller numbers and fewer species in the tidal waters than at the mouth of Pansipit River. Unfortunately not many years after the formation of the Palanas tidal streams a small portion of the connecting stream between these tidal waters and Pansipit River was cut off by the construction of a provincial road, and consequently the larval fishes have been prevented from migrating freely from Balayan Bay into Pansipit River by way of these streams. The larval fishes therefore remain in these streams to

grow into fingerlings or yearlings, and the people residing in the vicinity discovered in due time that they could catch countless numbers of them. As a result, the propagation stock of the important fisheries of Lake Taal and Pansipit River has been greatly diminished.

Another factor in the depletion of the fisheries of Lake Taal and Pansipit River is the unnecessary destruction of the breeding stock, brought about by the time-honored practice of awarding to the highest bidder the rights to fish in the waters. The municipalities of Taal and Lemery derive a large sum of money from the lease of fishing rights, and as this sum is paid in advance, the lease holders are obliged to catch and sell as much fish as possible to make good their investment. To this end the so-called "Baklad Pansipit," which blocks the entire width of the river, has been constructed. Practically all fish migrating seaward are caught in the Baklad Pansipit. Moreover, lease holders of the Pansipit fisheries also devise means to drive the fish from Lake Taal to the river in order to make the catching of the fish more complete, and therefore more exhaustive.

Thus the development of the migratory fishes that constitute the greatest volume of the commercial fisheries of Lake Taal and Pansipit River is seriously interfered with on two occasions: (1) During their larval stage upon their lakeward migration and (2) during their breeding stage when they travel seaward.

The records of catch of the "Baklad Pansipit" (Table 1), during three periods, 1888–1890, 1926–1927, and 1933–1934, show that the five species which compose the bulk of these fisheries, namely, the muslo, *Caranx marginatus;* the maliputo, *C. ignobilis;* the manipis, *Caranx* sp.; the lumulukso, *Chanos chanos;* and the banak, Mugilidæ, have been undergoing depletion. The average number of muslo taken in Baklad Pansipit during the three-year period from 1888 to 1890 was 14,352; from 1926 to 1927 it was 8,163; and from 1933 to 1934, 6,328. The catch of the third period was less than 50 per cent of that of the first period. The maliputo, manipis, lumulukso, and the banak likewise decreased markedly in number during these periods.

The depletion of these fisheries is also shown in the actual money value of the fishing rights. The lease for the period from 1928 to 1932 was 161,000 pesos, or 32,200 pesos annually. The lease for the period from 1933 to 1936 however, amounts to only 81,500 pesos, or 16,300 pesos a year, a decrease of about 50 per cent.

TABLE 1.—*Average number of fish caught in the Baklad Pansipit per annum.*

Year.	Muslo, *Caranx marginatus.*	Maliputo, *Caranx ignobilis.*	Manipis, *Caranx* sp.	Lumulukso *Chanos chanos.*	Banak, Mugilidæ.
1888	16,283	928	8,844	786	1,888
1889	12,369	1,474	10,630	1,520	4,200
1890	14,405	611	4,225	1,601	1,057
Average	14,352	1,004	7,899	1,302	2,381
1926	9,082	342	428	353	200
1927	7,244	372	2,886	334	311
Average	8,163	357	1,657	344	255
1933	5,969	207	1,107	420	527
1934	6,688	416	999	530	117
Average	6,328	311	1,053	475	322

MIGRATORY HABITS

Muslo, Caranx marginatus.—This pampano or talakitok breeds in salt water. The young, locally called pepikat, enter sloughs, mouths of rivers, and other sheltered bodies of water, and eventually ascend streams to enter a fresh-water lake, if such is available. My own observations in Balayan Bay in the vicinity of Lemery and Taal, the Palanas tidal streams at Lemery, and at the mouth of the Pansipit River in 1934, indicate that the young muslo make their lakeward migration almost the year round, but migration in greatest abundance of the pepikat (fingerlings of muslo) occurs during the period from January to April.

Under ordinary circumstances it is the general habit of this group of migratory fishes to remain in fresh water until sexual maturity, and to make the seaward migration when they are about ready to spawn. The muslo, however, is an exception to this general rule. Records of catch in the Baklad Pansipit show that the muslo return to the sea prior to maturity. Hundreds of muslo caught in Baklad Pansipit have been examined, and not a single specimen showed developed gonads. The seaward migration of the muslo has also been found to occur during all months of the year, as shown by the records of catches of the Baklad Pansipit for 1927 and 1934 (Table 2).

TABLE 2.—*Number of muslo taken by the month in Baklad Pansipit for 1927 and 1934.*

Month.	1927.	1934.
January	2,212	4,590
February	2,387	3,682
March	3,467	1,545
April	5,594	8,230
May	12,405	8,444
June	9,097	6,413
July	10,453	8,735
August	10,754	15,731
September	10,038	7,893
October	9,846	8,094
November	8,625	4,658
December	2,049	2,240
Total	86,927	80,256
Average	7,241	6,688

It is also apparent that more muslo migrate seaward from either April to October or May to November, the period from July to October being the height of the seaward migration.

The records of catch for 1934, where the number and weight of the muslo were recorded (Table 3), show that small and young muslo migrate seaward during August, September, and October. These months, especially August, are well known as the "pepikat-season" because of the abundance of small muslo in the catch. On the other hand, the so-called "muslong-laot" (large and old muslo) are caught in the Baklad Pansipit during April, May, June, and July.

TABLE 3.—*Number and average weight of muslo caught in Baklad Pansipit during 1934.*

Month.	Number.	Average weight.
		g.
January	4,590	168
February	3,682	172
March	1,545	196
April	8,230	203
May	8,444	213
June	6,413	238
July	8,735	304
August	15,731	149
September	7,893	152
October	8,094	166
November	4,658	172
December	2,240	177

Maliputo, Caranx ignobilis.—This species is the largest pampano in Philippine waters. It is also the largest among the fishes known to occur in Lake Taal, with the exception of a shark, *Carcharhinus* sp. Maliputo as heavy as 30 kilos have been caught in Baklad Pansipit. Such maliputo are locally called "sumañga." These are, however, quite rare.

Like the muslo, the maliputo is catadromous. It breeds in the sea, usually in deep water, while its young migrate to shallow water, even ascending rivers and eventually entering lakes where they stay for some time. In some cases the fish does not leave the lake on its seaward journey until after it has attained sexual maturity, or when it is ready to spawn in the sea. An example of this is the maliputo, *Caranx ignobilis.* Some migratory species, however, leave the fresh-water habitat to return to salt water when they are only a year old, or at least prior to sexual maturity. An example of this group of catadromous fishes is the muslo, *Caranx marginatus.*

Although it is generally known that the maliputo does not leave Lake Taal until it attains sexual maturity, my own observations at Baklad Pansipit give sufficient indication that such is not always the case. Small, immature maliputo, locally called "bulubuktok" are taken in Baklad Pansipit. These bulubuktok weigh on the average less than a kilo each. Records of catch at Baklad Pansipit for 1934 show that the bulubuktok make the seaward migration during August (Table 4).

TABLE 4.—*The number of maliputo taken from Baklad Pansipit in 1927 and 1934.*

Month.	1927.	1934.
January	0	0
February	0	0
March	503	0
April	1,075	0
May	73	407
June	139	413
July	568	533
August	205	1,716
September	0	32
October	0	42
November	42	47
December	0	143
Total	2,605	3,333
Average per month	372	416

Unlike the muslo which makes its seaward migration the year round, the maliputo makes its appearance in the Baklad Pansipit

as early as March or as late as May of each year. From September to December it is not as abundant as during June, July, and August (Table 5).

TABLE 5.—*The number of adult and young maliputo together with their total and average weight in kilograms taken from the Baklad Pansipit in 1934.*

Month.	Adult.			Young.		
	Number.	Weight.		Number.	Weight.	
		Total.	Average.		Total.	Average.
		kg.	*kg.*		*kg.*	*kg.*
January						
February						
March						
April				3	25	0.833
May	407	866.1	2.128			
June	413	822.1	2.136			
July	533	1,230.5	2.309			
August	1,716	4,525.0	2.643	2,365	1,894.7	0.801
September	32	168.3	5.259			
October	42	106.7	2.541			
November	47	110.3	2.347			
December	143	411.6	3.571			

The lakeward migration of the young maliputo, which locally are also called "pepikat," occurs in greatest abundance from January to April.

Lumulukso, Chanos chanos.—Lumulukso are the large bañgos, generally sexually mature. The lumulukso (literally jumping) gets its name from its habit of making high leaps whenever surprised or disturbed.

This fish is another truly catadromous species, spawning in salt water and the fry or larvæ migrating into brackish waters or ascending streams and entering fresh-water lakes where they grow to sexual maturity.

Bañgos fry begin to appear in Balayan Bay and its contiguous waters in March and disappear in July, but occur in greatest abundance during April, May, and June.

The season of abundance of bañgos fry in the coastal waters from Nasugbu to Calatagan, Batangas, is similar to that of Balayan Bay, as shown in Table 8.

Bañgos fry drift towards the shores soon after they are hatched. They then enter quiet waters, such as sloughs, tidal streams, and mouths of rivers. After they have grown into strong individuals (probably a month old, and provided with

TABLE 6.—*Partial count of the bañgos fry collected from Balayan Bay within the Municipality of Lemery during 1935.*

Date of capture.	Number of fry.	Value at 10 centavos per 100.
		Pesos.
April 10, 11, 12	22,335	
April 18, 19, 20	66,470	
April 24, 25, 26	139,800	
April 27, 30	511,710	
Total for April	740,315	740.32
May 1, 2, 3, 4, 5	381,000	
May 6, 7	301,160	
May 8, 9	55,970	
May 10, 11	32,980	
May 13, 14, 15	346,550	
May 16, 17	403,150	
May 20, 21, 22	683,170	
May 26, 27, 28	84,350	
Total for May	2,288,320	2,288.32
June 7, 8, 9	77,940	
June 10, 11	104,630	
June 12, 13	308,140	
June 14, 15	22,140	
June 16, 17	440,640	
Total for June	953,490	
Total for the season	3,982,035	3,982.04

TABLE 7.—*Partial count of the bañgos fry collected from Palanas tidal waters of Lemery, Batangas.*

Date of capture.	Number of fry.	Value at 10 centavos per 100.
		Pesos.
April 10, 11, 12	2,500	
April 24, 25, 26	5,100	
April 29, 30	20,000	
Total for April	27,700	27.70
May 1, 4, 5, 6	11,400	
May 14, 15, 16	10,500	
May 20, 21, 22	20,000	
Total for May	41,900	41.90
June 11, 12, 13	12,000	
June 14, 15	11,500	
Total for June	23,500	23.50
Total for the season	93,100	93.10

TABLE 8.—*Bañgos fry in coastal waters from Nasugbu to Calatagan, Batangas.*

Date of capture.	Number of bañgos fry.	Value at 10 centavos per 100.
		Pesos.
April, 1930		
May, 1930	1,598.000	
June, 1930	212,000	
July, 1930	212,000	
Total for 1930	2,022,000	2,022.00
April, 1931	676,000	
May, 1931	2,020,000	
June, 1931	656,000	
Total for 1931	4,352,000	4,352.00
April, 1932	376,000	
May, 1932	1,102,000	
June, 1932	1,730,000	
Total for 1932	3,208,000	3,208.00
April, 1933		
May, 1933	2,474,000	
June, 1933	3,222,000	
Total for 1933	5,696,000	5,696.00
April, 1934	50,000	
May, 1934	1,402,000	
June, 1934	552,000	
July, 1934	378,000	
Total for 1934	2,382,000	2,382.00
April, 1935	318,000	
May, 1935	5,684,000	
June, 1935	500,000	
Total for 1935	6,502,000	6,502.00
Average per year	4,197,000	4,197.00

scales) they move more freely into brackish water. Those that have the chance to ascend rivers even enter fresh-water lakes, where they remain for a number of years (most likely two to four years) until they become sexually mature and are ready to make the seaward migration. At this age bañgos generally attain a length of 50 centimeters and are locally called lumulukso.

It is commonly believed in Batangas Province that the lumulukso breeds or spawns in deep portions of the sea. The waters around Maricaban Island, and Calatagan and Bauan Peninsulas of Balayan Bay, are believed by many fishermen to be the breeding grounds of the lumulukso.

The time of the seaward migration of the lumulukso is shown by the records of catch in the Baklad Pansipit (Table 9).

Table 9 shows that the lumulukso make the seaward migration at any time of the year. Examination of the seaward-migrating lumulukso showed that those passing through Pansipit River and caught in the Baklad Pansipit during November, December, and January have somewhat developed and enlarged gonads. Those caught during February, March, April, and May have very much enlarged gonads and show sign of approaching spawning activity.

Table 9 also shows that during about 36 years, from the period of 1888–1890 to that of 1926–1934, the number of lumulukso

TABLE 9.—*Number of lumulukso taken in Baklad Pansipit.*

Year.	January.	February.	March.	April.	May.	June.
1888	----------	----------	110	110	17	250
1889	----------	374	4,096	873	----------	----------
1890	----------	1,831	3,595	784	----------	----------

Year.	July.	August.	September.	October.	November.	December.
1888	1,706	2,080	1,723	53	----------	1,030
1889	----------	1,000	----------	970	1,882	1,555
1890	124	807	411	5,664	1,132	58

Average a year for the period 1888–1890 1,374

Year.	January.	February.	March.	April.	May.	June.
1926	----------	----------	----------	----------	----------	46
1927	----------	29	29	107	243	263

Year.	July.	August.	September.	October.	November.	December.
1926	8	201	490	130	81	6
1927	765	657	11	1	----------	----------

Average a year for the period 1926–1927 185

Year.	January.	February.	March.	April.	May.	June.
1933	----------	----------	----------	----------	----------	4
1934	125	24	25	20	118	----------

Year.	July.	August.	September.	October.	November.	December.
1933	11	665	484	1,168	397	217
1934	564	557	1,747	1,170	868	623

Average a year for the period 1933–1934 476

taken from the Baklad Pansipit had markedly decreased, the difference being 1,374 and 185 (1926–1927 period) or 476 (1933–1934 period).

Banak (mullets, Mugilidæ).—Two species of banak or mullets, *Mugil melinopterus* (Cuvier and Valenciennes) and *Mugil macrolepis* (A. Smith), are definitely known to occur in Lake Taal. However, many species of mullets are known to occur in Pansipit River. Among them are *Mugil cæruleomaculatus* Lacépède, *M. ceramensis* Bleeker, *M. ogilby* Fowler, *M. vaigiensis* Quoy and Gaimard, *M. amarulus* Cuvier and Valenciennes, and *M. lepidopterus* Fowler.

The seaward migration of the banak of Lake Taal, principally *Mugil melinopterus* and *M. macrolepis,* lasts from July or August to January, as shown in Table 10.

Table 10 also shows that the number of migratory banak in Lake Taal has markedly decreased within the 36 years from the 1888–1890 to the 1926–1934 period.

The lakeward migration of the fry and fingerlings of the banak lasts from January to May, but is most marked during February, March, and April. During these months in 1934 I collected plenty of fingerlings of banak in the mouth of Pansipit River and in the tidal waters of the Palanas regions of Lemery. Fingerlings of these fish were also collected by me during April, 1934, in Pansipit River, at the place where the Baklad Pansipit is located. During May, 1934, I collected numerous fingerlings of mullets along the shallow edge of Lake Taal. During February, 1934, I collected fry and fingerlings of *Mugil ceramensis, M. macrolepis, M. lepidopterus, M. amarulus, M. ogilby,* and *M. melinopterus.*

The result of my observations further showed that the common *aligasin, Mugil ceramensis,* breeds almost the year round, its fry and fingerlings having been encountered during every month of the year.

Igat or palos, Anguilla mauritiana.—This eel is one of the largest in the Philippines and is the largest among the so-called fresh-water eels. Specimens as long as 2 meters, with a body circumference of 460 millimeters, are not uncommon. The igat is also one of the choicest food fishes among the Philippine eels.

The Mauritian eel is migratory and is truly a catadromous species. The females are about three or four times larger than the males. *Anguilla mauritiana* is reported to breed or spawn in very deep portions of the open sea. After spawning, the parent eels are said to die. The newly hatched larvæ are ex-

TABLE 10.—*The number of banak (mullets) taken by the month.*

Year.	Number of banak (mullets) taken in—					
	January.	February.	March.	April.	May.	June.
1888						
1889	1,500					
1890	274					

Year.	Number of banak (mullets) taken in—					
	July.	August.	September.	October.	November.	December.
1888		288	2,800			700
1889		100		1,300	5,400	700
1890				2,467	900	

Average for a year for the period 1888–1890 2,550

Year.	Number of banak (mullets) taken in—					
	January.	February.	March.	April.	May.	June.
1926						
1927	27					

Year.	Number of banak (mullets) taken in—					
	July.	August.	September.	October.	November.	December.
1926	207	4	29	222	2	12
1927	818	78				

Average for a year for the period 1926–1927 200

Year.	Number of banak (mullets) taken in—					
	January.	February.	March.	April.	May.	June.
1933						
1934	258	4			6	

Year.	Number of banak (mullets) taken in—					
	July.	August.	September.	October.	November.	December.
1933	319	1,121	392	164	471	889
1934	341		31	60	33	1

Average for a year for the period 1933–1934 325

tremely transparent and pelagic. They drift towards the mainland, and, upon reaching shallow shores, enter estuaries and river mouths where they undergo metamorphic changes from transparent, laterally flattened larvæ into the form of pigmented young, similar in appearance and shape to the adults. At this juncture, the females segregate themselves from the males and continue their migration, ascending rivers, entering lakes or climbing mountain streams, where they develop into sexually mature individuals 1 to 2 meters long.

It is reported that it takes one or two years for this eel to complete the lakeward or mountain-streamward journey. It is known to ascend mountain streams as high as 1,530 meters above sea level.

When about ready to spawn the females begin to undertake the seaward trip. Upon reaching the mouths of rivers, estuaries and bays, they again join the males, with whom they make the journey to the continental shelves of the sea.

It is said that upon reaching the continental shelf the sexually mature and ripe eels let themselves fall to the depth of the sea, and the pressure thus produced causes the eggs and sperm to ooze out. Fertilization, therefore, takes place in the water.

The time of seaward migration of *Anguilla mauritiana* is shown in Table 11.

TABLE 11.—*The number of Anguilla mauritiana taken from Baklad Pansipit by the month from 1926 to 1934.*

Year.	Number of *Anguilla mauritiana* taken in—											
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1926							1		4	1	1	1
1927	2		1			1	3					
1933						1	1	14	29	68	86	78
1934	38	30		1	3	1	3	4	9	53	126	15

Table 11 shows that the seaward migration of *Anguilla mauritiana* occurs during any month of the year, but is most marked between September and November.

Other migratory fishes.—Among migratory fishes of little economic importance entering the fisheries of Lake Taal and Pansipit River are buan-buan, *Megalops cyprinoides;* kitang, *Scatophagus argus;* maya-maya, *Lutianus malabaricus;* bakoko, *Pomadasys hasta;* lañgaray, *Ambassis* spp. These fishes are also catadromous and breed only in salt water.

Fishes that are permanent residents of Lake Taal.—The only species of commercial significance that resides permanently in Lake Taal is the tawilis, *Harengula tawilis* Herre. This herring is believed to have immigrated into Lake Taal from Balayan Bay or the China Sea. In order to assure the conservation of this important food fish of Lake Taal, immediate attention should be given to the problem of the regulation of the methods by which the tawilis are caught. The bayakus, now in use, is a fine-meshed drag-seine that catches even the smallest fry of this species in large numbers.

Other permanent residents of Lake Taal of little commercial importance are the biyá, *Glossogobius giurus*, and the dalag, *Ophicephalus striatus*. Even these two species are now overfished, as sexually immature individuals are caught in large quantities.

PROBLEMS OF CONSERVATION OF THE FISHERIES OF LAKE TAAL AND PANSIPIT RIVER

Condition of the fisheries and causes of depletion.—From the discussions and data presented in the early part of this paper certain conclusions suggest themselves with regard to the conservation of the valuable fishery resources of Lake Taal and Pansipit River.

(1) The fisheries of Lake Taal and Pansipit River have apparently decreased markedly, both in the volume of catch and in their actual value in pesos and centavos during a period of about 36 years.

(2) Such depletion may be traced to the following causes:

(*a*) The unnecessary destruction of larvæ, fry, and fingerlings of fishes migrating from Balayan Bay to Lake Taal by way of Pansipit River. These migratory fishes furnish Lake Taal with the necessary stock for the propagation of the important commercial species of fish in that body of water. Destruction of such propagation stock takes place at the following places: (1) In the mouth of Pansipit River and its contiguous waters in Balayan Bay. During March, April, May, and June, the fry of bañgos and of many migratory fishes are abundant there. Bañgos fry are caught in abundance by means of the *salap*, fine-meshed sinamay nets that are very effective for catching the fry not only of bañgos but of all kinds of fishes. During other months of the year fry and fingerlings of such migratory fishes as the banak, kitang, alsó, talakitok, lañgaray, and others are also caught by salap and sakag. *Pukot* (drag seines), which are

capable of catching small and young fishes, are operated in Balayan Bay near the mouth of Pansipit River. (2) In the Palanas tidal streams at Lemery, bañgos fry as well as fry of other migratory fishes are also effectively caught in abundance. Furthermore, the closing of the connection between these Palanas tidal streams and Pansipit River prevents the free migration of countless numbers of fry and fingerlings of migratory fishes from Balayan Bay into Lake Taal.

(*b*) Almost wholesale capture of adults and breeders which migrate seaward, either to develop into spawners or to breed in the sea, takes place at the following points: (1) In the open waters of Lake Taal where *pante* (gill nets) are extensively used to capture large fish. (2) Along the edge of Lake Taal, especially in the vicinity of the source of Pansipit River, where *baklad-bokana* (fish corrals) are constructed. Large fish on their way to Pansipit River preparatory to their seaward migration are caught in these fish corrals. (3) In Pansipit River, about a kilometer from the junction between Pansipit River and Lake Taal, a huge fish corral (Baklad Pansipit), blocking the entire width of the river, is constructed. In this baklad the greatest catches of Lake Taal fishes are made, and almost all the migratory fishes that leave Lake Taal to undertake the seaward journey are caught there. (4) In the lower portions of Pansipit River *salambao* (nets) are operated to catch fishes that escape the Baklad Pansipit from Lake Taal and those that are returning to the sea from the river itself. (5) In Balayan Bay, near the mouth of Pansipit River, baklad-bokana (fish corrals) and pukot (drag seines) are also operated to catch migratory fishes and fishes moving to and fro between the Bay and the River.

Measures for improving and conserving the fishery resources of Lake Taal and Pansipit River.—As the data of this study show, the fisheries of Lake Taal have undergone some depletion. The problem, therefore, is one of rehabilitation rather than one of conservation. Since the main cause of depletion is the unnecessary destruction of the larvæ, fry, and fingerlings of migratory fishes that compose the bulk of the fisheries, the catching of these must be regulated and restricted. To this end the following measures are suggested:

(1) The waters at the mouth of Pansipit River and its contiguous waters of Balayan Bay, for at least 200 meters from the general coastline, and 200 meters on each side of the mouth of Pansipit River, in the jurisdiction of Lemery and Taal, Batangas,

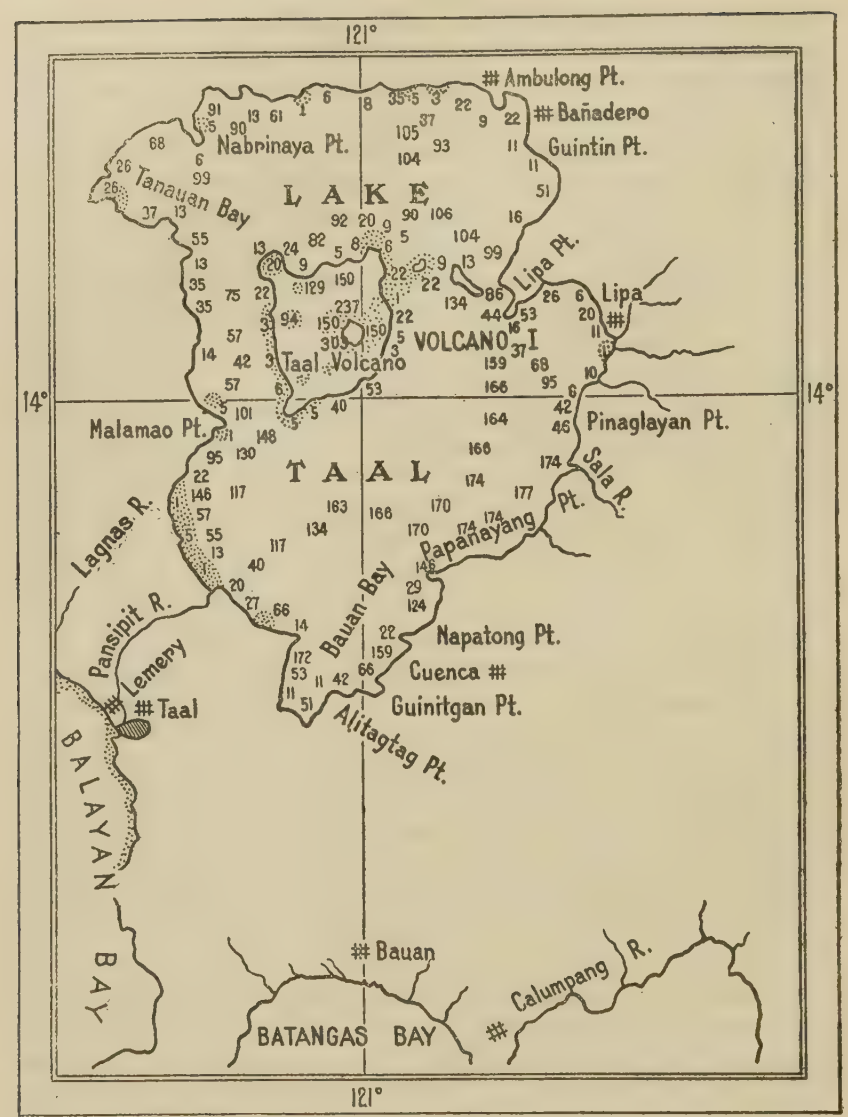

FIG. 1. Lake Taal and Pansipit River, including a portion of Balayan Bay. Pansipit River, connecting Lake Taal and Balayan Bay, is the only passage permitting the migration of fishes between these two bodies of water.

should be established as a fish sanctuary. This measure would have the effect of permitting undisturbed upstream and lakeward migration of a large volume of larval fishes, which eventually will reach Lake Taal to develop into individuals of marketable size or sexual maturity.

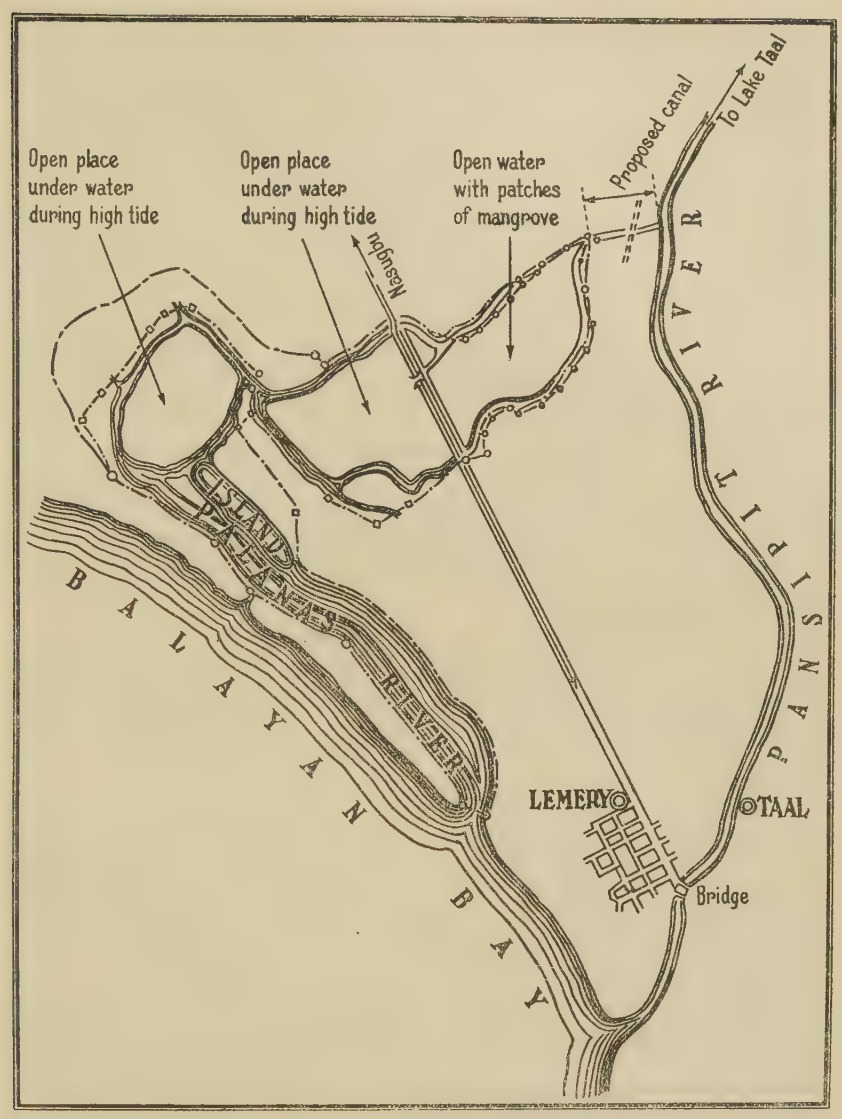

FIG. 2. Palanas River and its contiguous tidal streams at Lemery, including a portion of Balayan Bay. A portion of the tidal stream was closed when a provincial road was constructed through that point. The proposed canal to connect these tidal streams with Pansipit River will make possible the free migration of larval fishes from Balayan Bay into Pansipit River, and thence into Lake Taal.

(2) To further increase the volume of the larval migration from Balayan Bay into Pansipit River, and thence into Lake Taal, the following waters should also be converted into a fish sanctuary: The portion of Balayan Bay extending for 200 meters from the general coastline and 100 meters on each side of the

mouth of Palanas creek, including the entire tidal water of that creek and its tributaries, to its junction with Pansipit River in the jurisdiction of Lemery, Batangas. This Palanas area of Lemery is shown in text fig. 2. It is most important, however, that a canal be constructed to connect the Palanas tidal streams with Pansipit River. This canal would only be a few meters long and should cost the Municipalities of Taal and Lemery about 600 pesos to construct. The writer has repeatedly called the attention of the Municipal officials of Lemery and Taal, as well as that of the Provincial Officials of Batangas, to the urgent need for such a canal, and the Municipality of Lemery responded favorably by appropriating the sum of 200 pesos for the purpose. The Municipality of Taal has so far failed to give its share.[1] Through the efforts of the Provincial governor an item was included in the Appropriation Act for 1935, in which the sum of 5,000 pesos was to be set aside for the construction of the proposed canal, but unfortunately that item was among the many public works projects that came under the executive veto of the Governor General.

In line with the proposed protection of fry and larvæ of migratory fishes in Pansipit River, Balayan Bay, and elsewhere in the Philippines, the Bureau of Science has recommended the promulgation of Fish and Game Administrative Order No. 12, as follows:

Pursuant to the provisions of section 79 (B) of the Revised Administrative Code and of sections 4, 7, 8, 9, and 19 of Act No. 4003, entitled "An Act to amend and compile the laws relating to fish and other aquatic resources of the Philippine Islands, and for other purposes," and for the protection and conservation of banak and bañgos and certain fisheries in Batangas and Mindoro, the following rules and regulations are hereby promulgated for the information and guidance of all concerned:

1. *Five years close season.*—There is hereby established for five years from the date this Administrative Order takes effect a close season for the taking of all species of banak and bañgos and aquatic animals and plants or their parts or portions from all the waters described below:

(*a*) All the waters at the mouth of Pansipit River, 200 meters wide from the general coastline, and extending 200 meters on each side of the mouth thereof, in the jurisdiction of Lemery and Taal, Batangas.

(*b*) That portion of Balayan Bay, 200 meters wide from the general coastline and extending 100 meters on each side of the entrance or mouth of the Palanas creek, including the entire tidal water of the said creek

[1] June 11, 1937, the municipal council of Taal was reported to have appropriated the sum of 300 pesos as its share for the construction of the proposed canal. However, no negotiations have as yet been made with the owners of the land through which the canal in question would be constructed.

and its tributaries, to its junction with the Pansipit River, in the jurisdiction of Lemery, Batangas.

(*c*) All the waters at the mouth of Butas River, 200 meters wide from the general coastline and extending 200 meters on each side of the mouth thereof, in the jurisdiction of Naujan, Mindoro.

(*d*) All the waters around Paniquian Island, 200 meters wide from the general coastline in the jurisdiction of Puerto Galera, Mindoro.

2. *Prohibitions.*—It shall be unlawful at all times during the close season for any person, association or corporation to disturb or drive away from the areas described in the preceding section or in any manner take, kill or catch or cause to be killed, caught, or taken from these waters, purchase, sell, offer or expose for sale any aquatic animals or plants taken therefrom, dead or alive, or have in possession any part of same, except as provided in Section 3 of this Administrative Order.

3. *Exemptions.*—(*a*) For scientific, educational, personal or propagation purposes any person, association, institution or corporation of good repute may be granted by the Secretary of Agriculture and Commerce, free of charge, a permit to catch or take or cause to be caught or taken fishes of all sizes or aquatic animals and plants otherwise prohibited in this Administrative Order, subject to such conditions as the Secretary of Agriculture and Commerce may deem wise to impose for the proper conservation of the fisheries.

(*b*) Fish caught under these licenses but used for purposes other than those mentioned herein above shall subject the violators to the same penalty as if no permit had been granted.

4. *Enforcement.*—For the purpose of enforcing the provisions of this Administrative Order and of such regulations as may hereafter be promulgated, game wardens; members of the Philippine Constabulary; members of municipal and municipal district police; members of the secret service force; inspectors, guards, wharfingers of the Customs Service; internal-revenue officers and agents; officers of coast guard cutters and lighthouse keepers; and such other competent officials, employees or persons as may be designated in writing by the Secretary of Agriculture and Commerce, are hereby made deputies of said Department Head and empowered: (*a*) to arrest any person found committing or attempting to commit an offense against the provisions of Act No. 4003, and of this Administrative Order; (*b*) to seize, when deemed necessary, for evidence or for such purposes as the Secretary of Agriculture and Commerce or his duly authorized representative may consider advisable, any fishing gear or apparatus used or which may be used to catch, kill or take any protected fish or other aquatic animals or plants and fish caught or killed or aquatic animals taken or found in possession of any person, in violation of the laws and regulations; and (*c*) to file the necessary complaint in Court and report such violations to the Secretary of Agriculture and Commerce or to the Director of Science, for appropriate action (Sec. 5, Act No. 4003).

5. *Penalty.*—Any violations of the provisions of this Administrative Order shall subject the offender to prosecution and, upon conviction, he shall suffer the penalty provided in Section 83 of Act No. 4003, which is a fine of not more than two hundred pesos, or imprisonment of not more than six months, or both, in the discretion of the Court.

6. *Repealing provisions.*—All administrative orders and regulations or parts thereof inconsistent with the provisions of this Administrative Order are hereby revoked.

7. *Effectivity.*—This Administrative Order shall take effect on May 1, 1936.

(3) Another important cause of depletion of the fisheries under consideration is the almost wholesale capture of the breeders or spawners in Pansipit River. As has already been said, the migratory (catadromous) fishes must reach the salt water in order that they may develop their gonads or spawn. Since Lake Taal has but one outlet, Pansipit River, all fishes, in order to breed, must pass through Pansipit River, where almost all are caught in the Baklad Pansipit, a huge, permanent fish corral that blocks the entire width of the river. The baklad-bokana, baklad-wawa, and the salambao are also operated, with the same effect.

From the point of view of conservation and propagation, the most appropriate measure is the removal of the Baklad Pansipit. From the point of view of economics, however, this is hardly feasible, since by so doing the Municipalities of Taal and Lemery would lose the yearly income of 20,000 to 30,000 pesos derived from the lease of the rights to these fisheries. Most practicable, therefore, is the establishment of a short close season for seaward-migrating fish, so that a sufficient number of breeders may be allowed to reach the sea. It is also recommended that larvæ, fry, and fingerlings of migratory fishes be transplanted yearly from the mouth of Pansipit River or Palanas tidal streams to Lake Taal for purposes of propagation.

The best way to establish the close season is as follows:

The company holding the franchise to the fisheries of Lake Taal and Pansipit River should be required to provide a runway at least 5 meters wide in either wing of the Baklad Pansipit. This runway is to be opened only during the night, from 6 P. M. to 6 A. M., during the months designated hereunder for the following species:

(*a*) For the benefit of the muslo, *Caranx marginatus*, the month of August, when the greatest number of small muslo leave the lake for the sea. The average weight of the muslo of the 15,731 recorded in 1934 to have been caught in Baklad Pansipit is 149 grams (Table 3). This fish leaves the lake for the sea without first attaining sexual maturity. Therefore, those that should be protected are the young and small individuals that do not command a good price on the markets, and not the fish that are of marketable size.

(*b*) For the benefit of the maliputo, *Caranx ignobilis*, the runway should be opened during August also, as then the greatest number of adult and young maliputo migrate seaward (Table 5).

(*c*) For the benefit of the lumulukso fishery of Lake Taal and Pansipit River the runway should be opened during the last half of August and the first half of September, when the lumulukso appear to be migrating seaward and are ready to develop their gonads. The ideal period for the close season for lumulukso in Pansipit River is from November to January, when their gonads are well developed, but to this the lease holders of the fisheries would object, as they must recover the large amount paid to the Municipalities of Taal and Lemery. By allowing the seaward-migrating lumulukso a close season during the August–September period, the number of bañgos allowed to spawn would be sufficient to produce enough fry during the April–May bañgos-fry season in Balayan Bay in the neighborhood of the mouth of Pansipit River. A close season during the August–September period is also believed to be better than during the November–January period, because Pansipit River is deeper during the former than during the latter period, and hence the migrating lumulukso would have a better chance to reach the spawning ground. Other things being equal, the deeper the water, the more chance the fish have to escape during their journey in the River.

(*d*) For the benefit of the mullet or banak fishery, the runway should be opened during August. To protect further the spawning mullets (banak), the salambao (lever nets) should be prohibited in the Pansipit River during July, August, and September of each year.

(4) Another measure that can materially help in improving the productivity of the fisheries of Lake Taal and Pansipit River is the rescue and subsequent transplanting of larvæ, fry, and fingerlings of migratory fishes that become stranded in shallow portions of Balayan Bay, the Palanas tidal streams, sloughs, and other places in the vicinity of the mouth of Pansipit River. Among the fishes that have reacted favorably to the changes involved in transplanting fry from the brackish water to fresh water of the Pansipit River and Lake Taal are mullets (banak), bañgos, talakitok (Carangidæ), alsó (snappers), and kitang (spade or butterfishes). These larval fishes may be collected from time to time and transported in bancas or boats in which the water may be replaced with water at different portions of the Pansipit River during the trip from its mouth to Lake Taal.

Pansipit River is only 8 kilometers long, so that the transporting of the larval fishes is not difficult.

THE FISHERIES OF BALAYAN BAY

Commercial value.—An accurate estimate of the value of the fisheries of Balayan Bay is not available. However, taking into consideration the fact that the value of the fisheries of Lake Taal and the Pansipit River is conservatively estimated at 500,000 pesos annually, that of Balayan Bay should be more than twice that much. Balayan Bay is more than twice as large as Lake Taal, and undoubtedly has more species of commercial food fishes in large quantities than Lake Taal. (See page 192 and Table 12 for commercial food fishes.) The annual commercial value of the fisheries of Balayan Bay could therefore be conservatively estimated at 1,000,000 pesos. The yearly catches alone of the pelagic fishes, such as tunnies, mackerels, scads, sardines, herrings, and anchovies, would in all likelihood approach the estimated value. The value of the yearly catch of bañgos is placed at no less than 20,000 pesos.

Kinds of fish composing the fisheries of Balayan Bay.—The important species of fish found in Balayan Bay are listed in Table 12.

The seasonal occurrence of the commercial species of fish in Balayan Bay.—The fishing season for each of the commercial species of fish in Balayan Bay is shown in Table 13.

As shown by the catch in Lemery, Calaca, and Balayan, fish in Balayan Bay are abundant in the period from February to April, although they are not scarce during January, May, and June. Fish from Balayan Bay begin to appear in the markets in December. Certain species are caught in small numbers during July, and rarely and scarcely during August and September when fishing in Balayan Bay is possible only during calm weather.

Fishes of Balayan Bay that migrate into Pansipit River and Lake Taal.—Fry and fingerlings of the following species migrate from Balayan Bay into Pansipit River, and thence into Lake Taal. They supply the propagating stock of the most important fisheries of Lake Taal: Muslo, *Caranx marginatus;* maliputo, *Caranx ignobilis;* bañgos or lumulukso, *Chanos chanos;* banak, *Mugil* spp.; buan-buan, *Megalops cyprinoides;* palos or igat, *Anguilla mauritiana;* kitang, *Scatophagus argus;* bugin, *Hemirampphus quoyi;* bagaong, *Therapon* spp.; bakoko, *Pomadasys hasta;*

TABLE 12.—*Fishes entering the fisheries of Balayan Bay.*

Local name (Batangas).	English name.	Scientific name.	Family.
Tuliñgan	Oceanic bonito	*Euthynnus yaito* Kishinouye.	Thunnidæ,
Do	Frigate mackerel	*Auxis thynnoides* Bleeker	Do.
Tambakol	Yellowfin tuna	*Neothynnus macropterus* Schlegel.	Do.
Do	Albacore	*Thunnus germo* (Lacép.)	Do
Guliasan	Striped albacore	*Katwonus pelamis* (Linn.)	Do.
Tanigé	Spanish mackerel	*Cybium commerson* (Lacépède).	Scombridæ.
Lumahan	do	*Rastrelliger chrysozoma* (Ruppell).	Do.
Hasá-hasá	Short-bodied mackerel	*R. brachysomus* Bleeker	Do.
Galonggong	Round scad	*Decapterus macrosomus* Bleeker.	Carangidæ.
Do	do	*D. kurra* Bleeker	Do.
Matang-baka	Large-eyed scad	*Selar crumenophthalmus* (Bloch).	Do.
Salay-salay	Deep-bellied crevalle	*Caranx kallas* (Cuv. and Val.).	Do.
Do	do	*C. djedaba* (Forskål)	Do.
Do	do	*C. leptolepis* (Cuv. and Val.).	Do.
Oriles	Hardtail	*Megalaspis cordyla* (Linn.)	Do.
Muslong-laot	Pampano	*Caranx marginatus* Gill	Do.
Maliputong-laot	do	*C. ignobilis* (Forskål)	Do.
Talupak or dorado	Yellow leatherjacket	*Chorinemus lysan* (Forskål).	Do.
Talakitok	Pampano	*Caranx armatus* (Forskål).	Do.
Do	do	*C. malabaricus* (Bloch and Schneider).	Do.
Damis	Jack	*Hynnis momsa* Herre	Do.
Tawilis, tamban, tunsoy, manansi.	Herrings	*Harengula* spp.	Clupeidæ.
Manansing-laot, karis-karis.	Sardines	*Sardinella* spp.	Do.
Tambang-lapad	do	*Sardinella perforata* (Cantor).	Do.
Siliñasi	Fry of sardines and herrings.		Do.
Dumpilas	Herrings	*Ilisha hoevenii* Bleeker	Do.
Dilis, dulis, pilipitin	Anchovies		Engraulidæ.
Tuakang	Anchovy	*Stolephorus commersonii* (Lacépède).	Do.
Bolinao	do	*S. indicus* (Van Hasselt)	Do.
Dulong	Fry of anchovies, gobies, etc.		Engraulidæ, Gobiidæ, etc.
Asogon, torcilio	Barracuda	*Sphyræna jello* Cuv. and Val.	Sphyrænidæ.
Bicuda, babayo, rompe-candado.	Lockbreakers	*S. obtusata* Cuv. and Val.	Do.
Bañgos (small), lumulukso (large), kawag-kawag (fry).	Milkfish	*Chanos chanos* (Forskål)	Chanidæ.
Miralla	Slipmouth	*Leiognathus leuciscus* (Gunther).	Leiognathidæ.
Malauay	do	*L. equulus* (Forskål)	Do.
Sap-sap	do	*Leiognathus* spp.	Do.

TABLE 12.—*Fishes entering the fisheries of Balayan Bay*—Continued.

Local name (Batangas).	English name.	Scientific name.	Family.
Hiwas	Moonfish	*Mene maculata* (Bloch)	Menidæ.
Enles	Whitinglike inermiid	*Dipterygonotus leucogrammicus* Bleeker.	Inermiidæ.
Bisugo	Nemipterid	*Nemipterus japonicus* (Bloch).	Nemipteridæ.
Do	do	*N. tæniopterus* (Cuv. and Val.).	Do.
Kuyog	Siganid	*Teuthis* sp.	Teuthidæ.
Samaral	do	*Siganus* spp.	Do.
Aligasin	Mullet	*Mugil ceramensis* Bleeker	Mugilidæ.
Aguas	do	*M. macrolepsis* A. Smith	Do.
Do	do	*M. dussumieri* (Cuv. and Val.).	Do.
Banak	do	*M. melinopterus* (Cuv. and Val.).	Do.
Do	do	*M. cæruleomaculatus* Lacépède.	Do.
Do	do	*M. amarulus* Cuv. and Val.	Do.
Do	do	*M. vaigensis* Quoy and Gaimard.	Do.
Do	do	*M. ogilby* Fowler	Do.
Do	do	*M. lepidopterus* Fowler	Do.
Batalay	Garfish, needlefish, billifish, houndfish.	*Tylosurus giganteus* (Schlegel).	Belonidæ.
Kambabalo	do	*T. melanotus* (Bleeker)	Do.
Boguin siliw	Halfbeak	*Hemiramphus quoyi* (Cuv. and Val.).	Hemiramphidæ.
Sarmullete	Surmullet, goatfish	*Upencides vittatus* Bleeker	Mullidæ.
Do	do	*U. mollucensis* Bleeker	Do.
Do	do	*Upeneus indicus* (Shaw)	Do.
Do	do	*U. moana* (Jordan and Seale).	Do.
Lapu-lapu, kulapu, kaltang.	Groupers, sea bass	*Epenephelus* spp.	Epenephelidæ.
Apahap	White sea bass	*Lates calcarifer* (Bloch)	Latidæ.
Buan-buan	Tarpon	*Megalops cyprinoides* (Broussonet).	Megalopidæ.
Bidbid	Tenpounder	*Elops hawaiiensis* (Regan).	Elopidæ.
Bagaong	Grunt	*Therapon* spp.	Theraponidæ.
Bakoko	do	*Pomadasys hasta* (Bloch)	Pomadasysidæ.
Asohos	Whiting	*Sillago sihama* (Forskål)	Sillagonidæ.
Bolador	Flying fish	*Cypselurus oligolepis* (Bleeker).	Exocœtidæ.
Kitang	Spade or butterfish	*Scatophagus argus* (Boddaert).	Scatophagidæ.
Kabasi	Gizzard shad	*Nematolosa nasus* (Bloch)	Dorosomidæ.
Do	do	*Anodontostoma chacunda* (Hamilton-Buchanan).	Do.
Palos, igat	Fresh-water eel	*Anguilla mauritiana* Bennett.	Anguillidæ.
Guno	Silversides	*Atherina* spp.	Atherinidæ.
Mamali	Threadfins	*Polynemus* spp.	Polynemidæ.
Buñguan	Sea catfish	*Arius* spp.	Ariidæ.

alsó, *Lutjanus argentimaculatus;* malaway, *Leiognathus equulus;* lañgaray, *Ambassis* spp. The following species move back and forth between Balayan Bay and Pansipit River: Samaral, *Siganus* spp.; aligasin, *Mugil ceramensis;* banak, *Mugil amaralus* and *Mugil ogilby;* kambabalo, *Tylosurus melanotus;* lapulapu, *Epenephelus* spp.; apahap, *Lates calcarifer;* asohos, *Sillago sihama;* mamali, *Polynemus* spp.

Fishing methods and gear used in Balayan Bay.—The following is a list of fishing methods and gear employed in Balayan Bay. They are not described in detail in this paper because they are generally the same as those used in other parts of the Philippines, and have, as a rule, already been repeatedly treated in the Philippine Journal of Science and other Philippine publications. However, the most important ones are illustrated to show certain peculiar differences from their kind as used in other parts of the Philippines.

I. Nets.
  1. Pukot (drag seines).
    a. Pukot-pang-gabi (seines used during night fishing).
    b. Pukot-pang-araw (seines used during day fishing).
    c. Bayakus (very fine-meshed seines used in shallow waters).
  2. Pante (Gill nets).
    a. Panteng-pang-manansi (gill nets for sardines, herrings).
    b. Panteng-pang-banak (gill nets for mullets).
    c. Panteng-pang-lumahan (gill nets for mackerels and scads).
    d. Panteng-pang-tenigé (gill nets for Spanish mackerels).
    e. Panteng-pang-dañgat (gill nets for catching slipmouths, ambassids, and other small shore and river fishes).
    f. Sapiao (gill nets operated in conjunction with luminous lights to attract and catch fishes traveling in schools, such as anchovies and young sardines and herrings).
  3. Sakag (scissors nets).
    a. Sakag or sulong (scissors nets for catching shrimps, crabs, and small shore and river fishes).
    b. Daplis or kurukutok (scissors nets operated in conjunction with a rope feathered with pieces of coconut husk used for driving the fish towards the nets, used principally to catch banak and other shore and river fishes).
    c. Sagap or salap (nets used for catching bañgos fry).
  4. Salambao (lever nets used for catching river fish, especially the banak).
  5. Dala (cast nets).

II. Fish corrals.
  1. Baklad.
    a. Baklad-pang-malalim (deep-sea fish corrals, principally for catching thunnies, mackerels, carangoids, etc.).

TABLE 13.—*Seasonal occurrence of commercial fishes in Balayan Bay in 1935.*

[a, Abundant; f, few; s, scarce.]

Common name (Batangas).	Scientific name.	January.				February.				March.				April.				May.				June.			
		Week.				Week.				Week.				Week.				Week.				Week.			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Tuliñgan	*Euthynnus yaito* Kishinouye. *Auxis thynnoides* Bleeker	f	a	f	f	----	a	a	----	a	s	a	a	a	a	a	f	f	----	----	----	----		f	----
Tambakol	*Neothunnus macropterus* (Schlegel). *Thunnus germo* (Lacépède). [a]	----	----	----	----	a	a	f	----	f	f	a	----	f	a	a	a	----	f	f	----	a	f	f	a
Guliasan	*Katwonus pelamis* (Linnæus).	----	----	----	----	a	a	f	----	f	f	a	----	f	a	a	a	----	f	f	----	a	f	f	a
Tanigé	*Cybium commerson* (Lacépéde).	----	----	----	s	----	s	----	----	a	a	a	a	f	a	a	f	----	s	s	----	s	----	s	----
Lumahan	*Rastrelliger chrysozoma* (Ruppell).	----	----	----	----	f	a	f	a	----	a	a	f	a	a	f	a	----	f	----	----	----	----	f	----
Hasá-hasá	*Rastrelliger brachysomus* Bleeker.	----	----	----	----	f	a	f	a	----	a	a	f	a	a	f	a	----	f	----	----	----	----	f	----
Galonggong	*Decapterus macrosomus* Bleeker. *Decapterus kurra* Bleeker.	a	a	a	a	a	f	a	f	----	f	f	----	----	s	----	s	----	----	----	----	----	----	----	----
Matang-baka	*Selar crumenophthalmus* (Bloch).	----	----	----	f	a	a	f	a	f	s	a	a	f	s	a	a	----	f	----	----	----	f	s	----
Hiwas	*Mene maculata* (Bloch)	----	s	f	f	----	f	f	f	a	f	a	a	s	f	f	s	----	s	----	f	----	s	f	----
Dilis	Engraulidæ (anchovies)	f	f	f	f	s	a	a	a	----	a	a	----	----	f	f	----	----	f	f	----	s	f	s	----
Salai-salai	*Caranx kallas* (Cuv. and Val.). *Caranx djedaba* (Forskål). *Caranx leptolepis*	----	----	s	f	----	a	a	f	f	a	a	f	a	f	a	a	----	f	s	----	s	f	s	s

| | | |

TABLE 13.—*Seasonal occurrence of commercial fishes in Balayan Bay in 1935*—Continued.

Common name (Batangas).	Scientific name.	July.				August.				September.				October.				November.				December.			
		Week.				Week.				Week.				Week.				Week.				Week.			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Tulifigan	*Euthynnus yaito* Kishinouye.	s	f	f																					
	Auxis thynnoides Bleeker																								
Tambakol	*Neothunnus macropterus* (Schlegel).		f	f	f	s					f	a													
	Thunnus germo (Lacépède). [a]																								
Guliasan	*Katwonus pelamis* (Linnæus).		f	f	f	s					f	a													
Tanigé	*Cybium commerson* (Lacépède).																								
Lumahan	*Rastrelliger chrysozoma* (Ruppell).																								
Hasá-hasá	*Rastrelliger brachysomus* Bleeker.																								
Galonggong	*Decapterus macrosomus* Bleeker.																	s	f	f	f	f	a	a	a
	Decapterus kurra Bleeker																								
Matang-baka	*Selar crumenophthalmus* (Bloch).																								
Hiwas	*Mene maculata* (Bloch)		s	f	s																				
Dilis	Engraulidæ (anchovies)		s	f		s	f														s	f	f	f	f
Salai-salai	*Caranx kallas* (Cuv. and Val.).																								
	Caranx djedaba (Forskål)																								
	Caranx leptolepis																								

| | | |

b. Baklad-pandak (shallow-water fish corrals for catching sardines, herrings, anchovies, mackerels, scads, round scads, and other species that travel in schools in fairly shallow waters).

c. Baklad-pang-ilog (river fish corals used principally to trap migratory fishes).

d. Baklad-pang-bukana (fish corrals placed in the lake near source of river to catch principally migratory fishes).

e. Baklad-pang-wawa (fish corrals placed in Bay near mouth of river to catch principally migratory fishes).

III. Hook-and-line.

1. Pahila (trollings).
   a. Trolling with live bait.
   b. Trolling with artificial bait.
   c. Trolling with dead fish and other animals as bait.
2. Kitang or haihai (set lines baited with shrimps, squids, crabs, pieces of fish, and other kinds of suitable bait).
3. Tubog (long lines with sinkers). This is known as still-line fishing.
4. Baliuasnan (hook-and-line tied to an end of bamboo or wooden pole).
5. Kawil-pang-pusit (hook-and-line for catching squids).

IV. Other gear and fish traps.

1. Bobó (basket fish traps with bait).
2. Bombon (bunches of twigs or branches of trees submerged in water to serve as traps).

Comparative statements as to the effect of some fishing gear upon certain fisheries of Balayan Bay.—On the basis of observations made for nearly one year (1934) on the composition of catch, the following may be regarded as affecting, one way or another, certain fisheries of Balayan Bay.

(1) All kinds of drag seines used in Balayan Bay catch large quantities of fry of sardines and herrings (siliñiasi) during February, March, and April. The bayakus catches the greatest number of siliñiasi. During these months these young fish are abundant, and are taken in appreciable numbers even in nets of the fish corrals.

(2) From February to April siliñiasi are also taken in large quantities by a fine-meshed gill net, called sapiao, and operated in conjunction with powerful luminous lights to attract schools of fishes, principally the clupeids and engraulids. The sapiao is of only recent introduction in Balayan Bay.

(3) The bayakus catches not only fry of sardines and herrings, but also anchovies and many other fishes occurring in the comparatively shallow waters of Balayan Bay.

(4) The sakag (scissors nets) are quite destructive to the larval fishes and crustaceans of Balayan Bay and its contiguous waters in the mouth of Pansipit River, resulting in the depletion of the fry and fingerlings of the migratory fishes.

(5) Fish corrals, especially the deep-sea baklad, should be given encouragement in Balayan Bay, as they do not catch immature fish but principally capture the large migratory fishes of the open waters, such as the tunnies, mackerels, and scads. Large-meshed gill nets should also be encouraged as they tend to catch only large and mature fishes.

RECOMMENDATIONS

For the purpose of following up the study of the fisheries of Balayan Bay, especially with regards to the proper conservation and utilization of its natural resources, the following recommendations are made:

(1) The distribution, seasonal occurrence, and migration of the important pelagic fishes such as Thunnidæ, Clupeidæ, Engraulidæ, and Scombridæ should be studied thoroughly. The Clupeidæ and Engraulidæ are already reported to have decreased markedly in recent years. The use of the sapiao, which is of recent introduction in Balayan Bay, should be looked into carefully in view of its effectiveness in catching young clupeids and anchovies. The bagoong industry of Balayan which requires large quantities of anchovies is now almost ruined, due to the scarcity of these fish.

(2) The use of fishing gear that are used solely in shallow waters and catch mostly larval and young (immature) fishes of commercial value should be regulated, after thorough study of the composition of their catch.

(3) The advisability and practicability of establishing refrigeration units in certain points in Balayan Bay, preferably in Lemery and Balayan, should be looked into. In these two towns large and oftentimes excessive catches are landed periodically, so that fresh fish have to be disposed of at a very poor price; yet, one or two days thereafter, the price rises up to a point where the average consumer cannot afford to buy.

(4) A more vigorous campaign should be waged in the enforcement of the dynamite law in the regions of Balayan Bay. The use of this explosive has been largely responsible for the destruction of fish and the prevention of the entrance into Balayan Bay from the open sea of schools of pelagic fishes.

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ILLUSTRATIONS

PLATE 1

Schematic drawing of the deep-sea fish-corral (baklad), called "madalang" in Batangas Province. Heavy stones are attached to the ends of bamboo poles holding them in place, as it is impossible to set the poles in a bottom that is rocky or covered with corals.

PLATE 2

Schematic drawing of shallow-water fish corral (baklad), called "malimit" or "pandak" in Batangas Province.

PLATE 3

Schematic drawing of very shallow fish corral (baklad), called "panak" in Batangas Province.

PLATE 4

Schematic drawing of drag seine used in Batangas Province, where it is called "pukot-pang-gabi."

TEXT FIGURES

[Drawn by Francisco Rafael.]

FIG. 1. Lake Taal and Pansipit River, including a portion of Balayan Bay. Pansipit River, connecting Lake Taal and Balayan Bay, is the only passage permitting the migration of fishes between these two bodies of water.

2. Palanas River and its contiguous tidal streams at Lemery, including a portion of Balayan Bay. A portion of the tidal stream was closed when a provincial road was constructed through that point. The proposed canal to connect these tidal streams with Pansipit River will make possible the free migration of larval fishes from Balayan Bay into Pansipit River, and thence into Lake Taal.

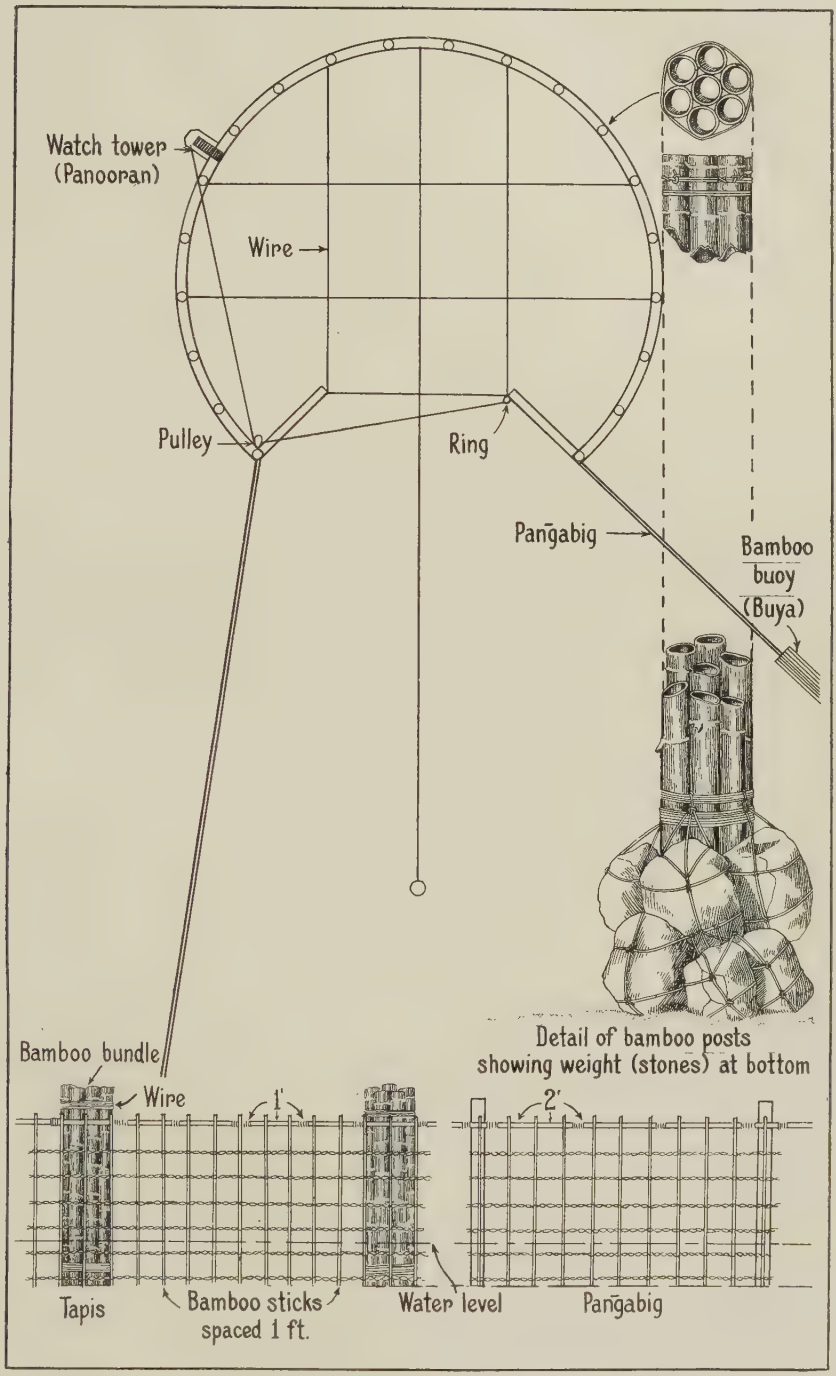
Watch tower
(Panooran)
Wire
Pulley
Ring
Pangabig
Bamboo
buoy
(Buya)
Detail of bamboo posts
showing weight (stones) at bottom
Bamboo bundle
Wire
1'
2'
Tapis
Bamboo sticks
spaced 1 ft.
Water level
Pangabig

PLATE 1.

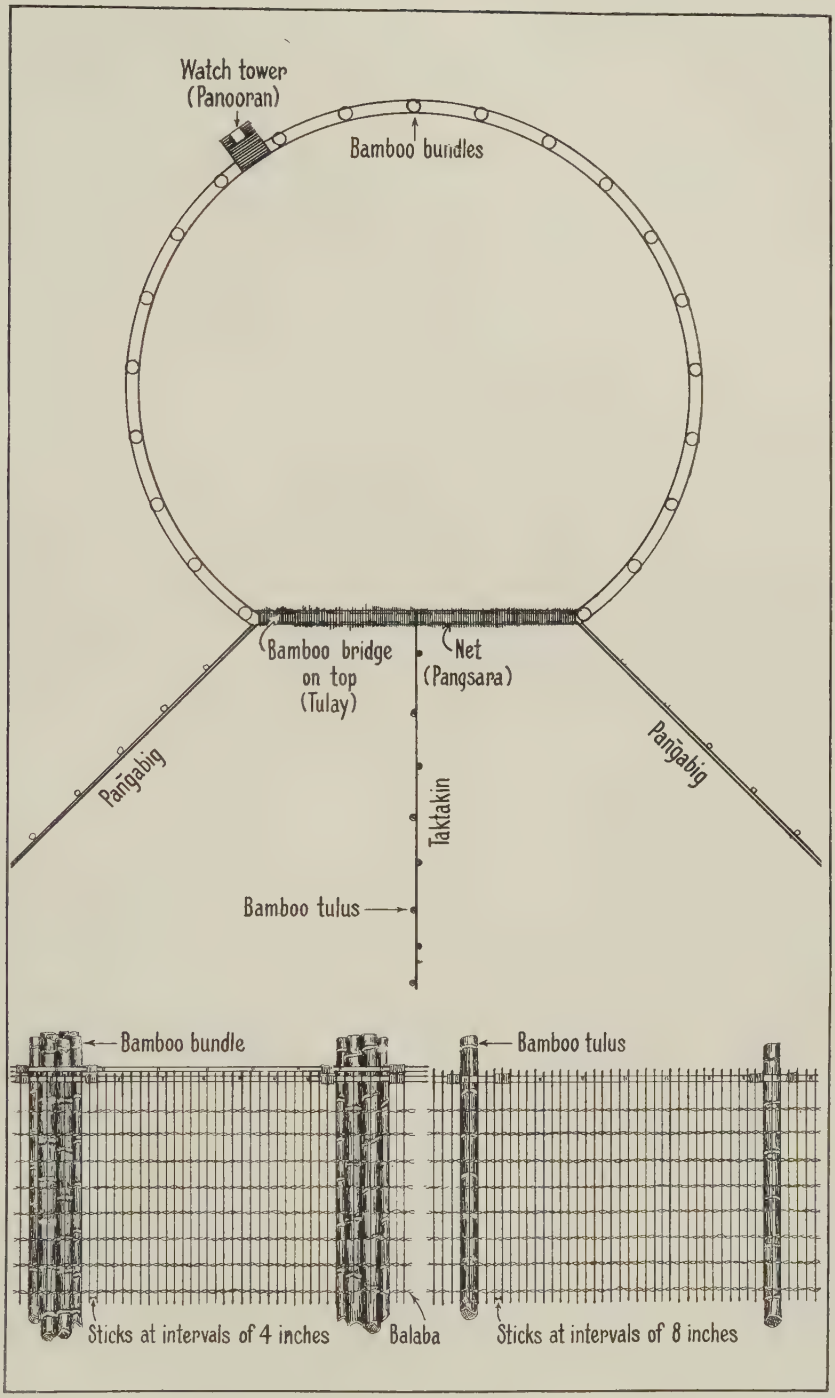
Watch tower
(Panooran)
Bamboo bundles
Bamboo bridge
on top
(Tulay)
Net
(Pangsara)
Pangabig
Pangabig
Taktakin
Bamboo tulus
Bamboo bundle
Bamboo tulus
Sticks at intervals of 4 inches
Balaba
Sticks at intervals of 8 inches

PLATE 2.

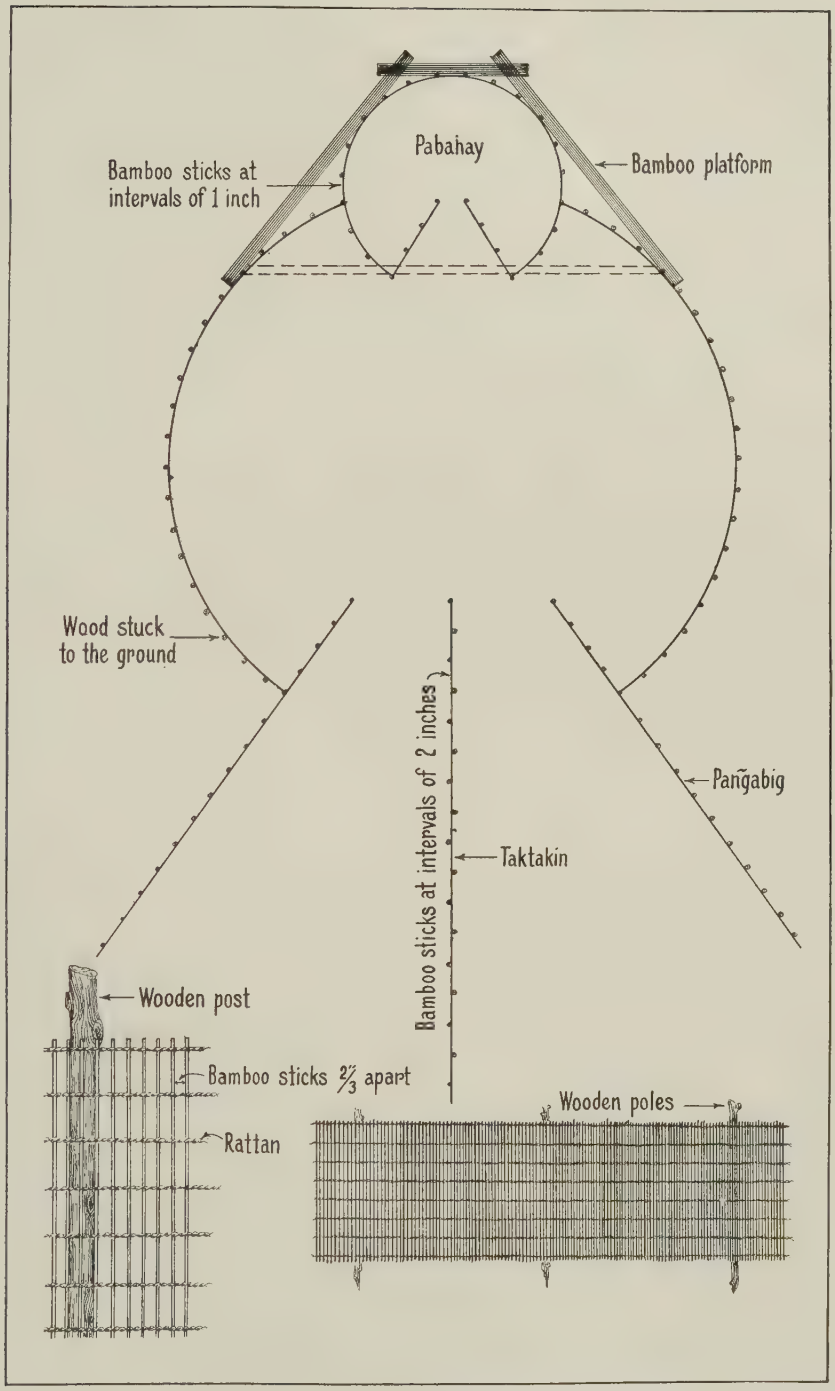
Pabahay
Bamboo sticks at intervals of 1 inch
Bamboo platform
Wood stuck to the ground
Bamboo sticks at intervals of 2 inches
Pangabig
Taktakin
Wooden post
Bamboo sticks 2/3 apart
Rattan
Wooden poles

PLATE 3.

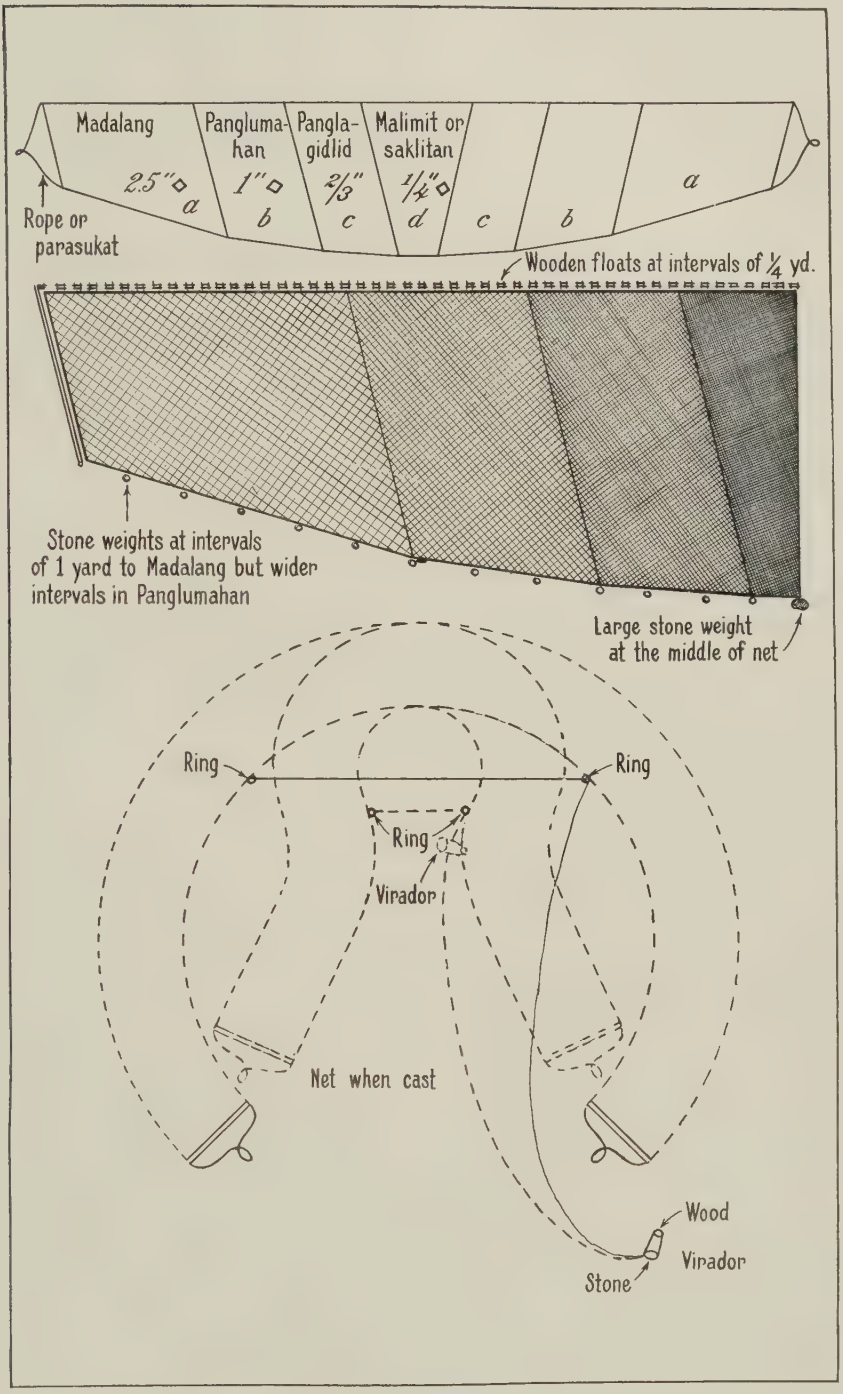
Madalang
Pangluma-han
Pangla-gidlid
Malimit or saklitan
2.5" ◇
1" ◇
⅔"
¼" ◇
a
b
c
d
c
b
a
Rope or parasukat
Wooden floats at intervals of ¼ yd.
Stone weights at intervals of 1 yard to Madalang but wider intervals in Panglumahan
Large stone weight at the middle of net
Ring
Ring
Ring
Viradon
Net when cast
Wood
Viradon
Stone

PLATE 4.

THE FISHERY INDUSTRIES OF SAN MIGUEL BAY

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Of the Fish and Game Administration, Bureau of Science, Manila

SEVEN PLATES AND NINE TEXT FIGURES

INTRODUCTION

San Miguel Bay is one of the few rich fishing areas in the Philippines that are convenient and profitable during the southwest monsoon. It is rich because of its enormous supply of aquatic resources, convenient because it is least exposed to the prevailing monsoon, and profitable because the produce reaches the market when the supply of fresh fish is at its minimum, the majority of the fishing grounds in the Islands being exposed and thus unproductive during this most stormy part of the year.

The bay is somewhat pear-shaped in general outline, extending 18 miles southward from the entrance between Caringo and Siruma Islands and varying in width from 5.5 miles at this narrow entrance to 16 miles at its greatest width, the latter being about 4 miles distant from the head. Plate 1, adapted from Chart No. 4223 of the U. S. Coast and Geodetic Survey, shows the fishing grounds in this region and the extent of the available areas, the nature of the bottom, and the 5-fathom (dotted) line at mean low water.

Although a considerable part of the waters of the bay on the western coast falls under the jurisdiction of two towns in Camarines Norte Province, the major portion is under the control of five towns of Camarines Sur Province, from Siruma on the eastern coast to Sipocot on the western. The inhabitants of the towns of Cabusao, Calabanga, Tinambac, and Siruma are principally, if not solely, dependent upon the fishery resources of the bay for their livelihood. The bulk of the revenue of the local governments of these municipalities is derived from the fees collected for the privilege of fishing. Thus the state of the fishery will serve to indicate the living condition of the populace and the financial status of the local governments. Even a superficial glance at the economic conditions prevailing in these

regions will not fail to reveal the importance of fisheries. However, because of injudicious exploitation of these valuable resources, the fishermen being interested merely in gathering all they can without giving the least thought to the prevention of depletion, it is imperative that regulatory measures based on intensive researches be formulated and enforced, not only by control on the part of the municipal authorities concerned, but also through the more desirable medium of education. The inhabitants should be acquainted with the necessity for such precautions in order that the richness of these grounds may yet be handed to posterity.

Table 1 shows the income from fishery of the different municipalities situated on San Miguel Bay, as compiled from the trial balance records of the Bureau of Audits, Manila. Most of this fishery income is derived from San Miguel Bay.

TABLE 1.—*Income in pesos from fisheries on San Miguel Bay for the period of 1931 to 1935 inclusive.*

Municipality.	1931	1932	1933	1934	1935
Daet [a]	264.78	416.00	393.50	261.75	296.75
Basud	21.00	----------	36.50	30.00	28.50
Sipocot [a]	218.75	265.00	33.75	46.76	111.25
Cabusao	1,507.45	1,298.50	821.50	617.00	475.00
Calabanga	1,310.00	1,790.25	858.75	970.25	1,101.00
Tinambac	721.50	537.50	227.50	536.75	467.00
Siruma	994.50	825.70	559.00	511.50	583.80
Total	5,037.98	5,132.95	2,930.50	2,974.01	3,063.30

[a] Incomes only partly derived from the San Miguel Bay fisheries.

Table 1 shows that Calabanga leads in the fishing activities around the bay, and receives the greatest income from fishery from year to year. In the following paragraphs the status and importance of the fishery in each of the municipalities bordering on the bay, from Siruma on the extreme eastern end to Daet on the western, is graphically presented.

Siruma.—The new town of Siruma is situated on the northern shore of Siruma Bay, about 1.8 miles east of Siruma Point. The old townsite, about 1 mile east of Quelon Point, is now the barrio of Matandang Siruma.

Of the different municipalities around the bay, Siruma has the coastline that is most indented with smaller bays, foremost among which are Siruma Bay, Sapenitan Bay, and Butauanan Bay. The nature of its coastline makes Siruma a very rich

fishing ground. Although the peak of the season is during the northeast monsoon, fishing is pursued in some parts almost the year round. The sea bottom in this vicinity is also the most rocky portion of the bay, the water being clear, deep, and steep-to. Thus a very profitable industry is being carried on in the catching of reef dwellers by hook and line with or without the use of light. Not only is the ground rich in coral reef species, but the shore is also frequented by pelagic game fishes seeking shelter; these species, also, are frequently caught by hook-and-line fishermen. The area is a good hiding place for these pelagic game fishes because portions of it are protected from both monsoons. The grounds in the neighborhood of the barrio of Tandoc in Butauanan Bay are an example. However, the two most important fishing barrios in the municipality are Bito and Sulpa.

Although the lumber industry is also very important in this region, especially in Tandoc where the largest sawmill in the Bicol region is situated, fishing is an important occupation, if not the most important, of the people, because of the presence of these rich fishing areas. Fish-corral and hook-and-line fishing are the most important methods employed. *Aboy bating, kub-kub, chinchorro, palubog, pamalao, laya,* and *bobo* are frequently employed during the northeast monsoon. Icing of the large-sized species and preservation by drying and salting are engaged in, especially in Bito where the corral fishery of this municipality is located.

Tinambac.—Although its waters are not as rich a fishing ground as the waters of Siruma, Tinambac has jurisdiction over favorable areas for the construction of fish corrals and the operation of the beam trawl during the northeast monsoon, the grounds being least exposed during this time of the year.

Tinambac is situated at the mouth of Himoragat River, towards its northern bank. Fishing and lumbering are the two important occupations of the inhabitants, especially since the collapse of the abaca and coconut industries. Bagacay, Buenavista, and Cagliliog are fishing barrios where enormous quantities of *balao* (tiny shrimps) are caught. The waters of the latter two barrios are especially favorable during the northeast monsoon and are usually frequented at this time of the year by net fishers from Calabanga.

Fish corrals, hook and line, palubog, *sakag, sapiao,* pamalao, *patalang sa tamban* or *panglambang,* and *bintol,* are the important appliances employed.

The preservation of the catch by drying and salting and the making of *bagoong* and *dinailan* are actively engaged in during the period of abundant catch.

Calabanga.—Although a somewhat interior town, Calabanga is the most important fishing center in San Miguel Bay, having jurisdiction over a long section of the southern coast. Its fishing areas are very profitable during the southwest monsoon, where fish corrals literally dot the shore, although they are somewhat barren during the northeast monsoon.

Balonĝay and Punta Calabanga are fishing barrios of Calabanga that are located at the mouth of Bicol River—the former having been the base of the Japanese trawlers at the start of their operations in San Miguel Bay. Sabang Calabanga is purely a fishing locality, thickly populated and all humming with fishing activity from February to September of each year. It is, in fact, the landing center of the major catch from San Miguel Bay during this part of the year. Fish dealers call at this place during the early hours of the morning to make their purchases for marketing of fish either in the fresh state at the town market in Naga or for curing for market on some future date either in the smaller towns of the Camarines Provinces or in Manila. The larger fishes are sent to Manila by rail. Fishermen from Manila Bay have settled here and are introducing their devices of fishing and their methods of preserving the catch. Fish-preservation plants for drying and salting are located in this barrio. Fish-corral, hook-and-line, kubkub, palubog, panglambang, aboy bating, and sakag are the most important methods of fishing.

Another important fishing barrio of Calabanga is Sibobo, the base of the three Japanese trawlers operating in the bay. Every morning, including Sundays, the fish dealers make their call at this place for the trawler's catch. Small salting and drying establishments are located there. Fish corrals dot the shores during the southwest monsoon.

Besides the purely fish-catching industry carried on in Sibobo, the barrio is a very rich collecting ground for window shell, where these shells are picked with the bare hands and sold to a Chinese dealer.

Cabusao.—The town of Cabusao is located on the western bank at the mouth of Bicol River. During the southwest monsoon it ranks second in importance as a fishing center. All its important barrios are fishing villages, foremost among which are Castillo and Barceloneta. Because of the extremely muddy

bottom and the shallow water with abundant accumulations of sediment carried by Bicol River, the fishery is especially rich in shrimps. Fishing for *balao* (very tiny shrimps) is actively engaged in during the entire fishing season, but especially during June and July.

In this town the fish corral is also the most important fishing gear. Other gear employed are palubog, *sabay,* sakag, laya, *sarap,* and *largarete.*

Curing is engaged in to some extent—drying and salting of fish and the making of *hibe* and dinailan for the preservation of shrimps.

Sipocot.—This municipality is located in the interior, but it has jurisdiction over a portion of the western coast of the bay. It derives its fishery income from both San Miguel Bay and Ragay Gulf, exercizing control over Caima Bay in the latter.

Towards San Miguel Bay its fishing grounds and fishing conditions are not very different from those of Cabusao, its neighbor on the coastline of San Miguel Bay. The barrio of Cotmo is the only important fishing community under its jurisdiction.

Daet.—With the exception of a small strip of water under the municipality of Basud, Camarines Norte Province, the waters of San Miguel Bay after Sipocot and on the opposite western shore of Siruma are under the municipality of Daet, the capital of Camarines Norte Province. Daet itself is situated toward the interior, but it has control over a considerable portion of the western coast of the bay. Lalawigan, Matoogtoog, and Mercedes are the important fishing barrios, the last-named being the landing center of the catch for marketing in Daet, Paracale, and Mambulao, all rich markets for fish.

The coast is well indented, especially in the vicinity of Mercedes where there are several smaller islands. Considerable areas have rocky bottoms, so that reef dwellers are not infrequently caught by hook and line and in fish corrals. The well-protected grounds between the smaller islands southeast of Mercedes are favorable sites for the construction of fish corrals the year round. In effect, the corral fishery of Daet is almost wholly confined to this locality where the current is not so swift.

Basud.—As has been stated above, a portion of the western shore of San Miguel Bay falls under the jurisdiction of Basud, another interior town south of Daet. Añgas is the important fishing barrio where fish corrals and hook and line are the important devices employed.

FISHING CONDITIONS

Although fishing is carried on in different portions of San Miguel Bay the year round, the peak of the season is during the southwest monsoon, when the greater length of the coastline is least exposed to the two distinct monsoons prevailing in the Philippines. Such areas along the southern and western coasts under the jurisdiction of the municipalities of Calabanga, Cabusao, and Sipocot are all rich and favorable grounds during this part of the year. During the northeast monsoon, fishing becomes more active along the eastern coast, the waters under the jurisdiction of the municipalities of Tinambac and Siruma. In baylets and coves protected from the monsoons, fishing is carried on throughout the year, the condition obtaining, for instance, in the barrio of Tandoc, Siruma Municipality, where there are good fishing grounds for hook-and-line fishing for the larger species of game fishes. In view of the prevailing conditions, fish corrals along the eastern coast are set during September and removed before the end of May; on the western coast they are set in February or in March and removed during the latter part of September before the northeast monsoon.

Although scattered patches of rocky bottom are in different portions of the bay, especially in the neighborhood of the entrance along the western, but more so on the eastern coast, the ground as a whole is smooth, sand bottom in some parts and soft mud in others, the latter being more noticeable near the mouth of Bicol river toward the southern and southwestern areas. For the most part the bay is very shallow, especially towards the southern coast where the depth of the water decreases very gradually until it becomes extremely shallow even at a great distance from the shore. Besides a number of smaller rivers, two large rivers (Bicol and Looc) empty into it, carrying enormous amounts of plankton which serve to enrich the area for the feeding of the various species of aquatic animals.

Although the greater portion of the bay is very shallow and is filled with the stumps of the posts of old and discarded fish corrals, especially the area within the five-fathom line, the middle portion is of moderate depth with smooth bottom, a condition favorable for trawling operations even if only to a limited extent. In effect, the middle portion of the bay is the operating ground of the trawlers. In view of its proximity to a vast body of water (the Pacific Ocean), the current is quite strong at all times of the year, and especially during the change of tide.

Added to the velocity of the tidal current is the effect of the current caused by the prevailing winds. In the absence of wind current the trawls, which are always dragged with the direction of the current, are towed towards the south or landward during flood, and towards the north or seaward during ebb. Otherwise operated, it has been found impossible to drag the net with the 40-horse-power engines used by the trawlers. Like the other important fishing gear employed in the bay, the trawls fish along the western coast during the southwest monsoon and along the eastern coast during the advent of the northeast monsoon. The prevalence of large numbers of various species of jellyfishes in these waters, especially during the southwest monsoon, has become a great handicap to proper trawling operations, so much so that the three Japanese trawlers were forced to stop fishing because of losses occasioned by the very much diminished catch. Apparently the sting of these jellyfishes has some effect upon the fishes, scaring them away by their nematocysts. It has been observed, however, that during the northeast monsoon there are not so many of these pests, and that trawling is profitable in this region at such times.

Unlike the practice in other fishing centers, fishing with light is not very actively done in San Miguel Bay, as there are only a few occasional runs of those pelagic migratory species that appear in vast schools and are the only fishes readily caught by this method. Some fish-corral owners, a few largarete outfits, and a few of line fishermen, employ light to a limited extent.

COMMERCIAL CATCHES

Although large-sized pelagic game fishes, like the tunas, Spanish mackerel, barracudas, and reef-dwellers like the groupers, are caught by hook-and-line fishermen operating in Tandoc and Mercedes, these fishes are, in general, not found in abundance or caught in quantities inside the bay. The major resources of the bay lie in the large quantities of shrimps (*Penæus* spp.) croakers (Sciænidæ), spotted pomadasids (*Pomadasys hasta*), sea catfishes (*Arius leiotetocephalus*), and crabs (*Neptunus pelagicus*). Window shells (*Placuna placenta*) abound in the vicinity of Barrio Sibobo.

Although limited quantities of herrings (*Sardinella perforata*), anchovies (Engraulidæ), mullets (*Mugil* spp.), and mackerels (*Rastrelliger brachysomus*), are occasionally caught, it can be deduced from the above that the richness of these fishing grounds

TABLE 2.—*Commercial species of fishes caught in San Miguel Bay.*

Bicol name (San Miguel Bay).	English common name.	Scientific name.
Abo	Large-mouthed croaker	*Otolithes argenteus* Cuvier.
Aliso	Silver-spotted gray snapper.	*Lutjanus argentimaculatus* (Forskål).
Arado	Guitar fish	*Rhynchobatus djiddensis* (Forskål).
Arakaak	Plain croaker	*Johnius aneus* (Bloch).
Araran	Mullet	Mugilidæ.
Atoloy	Crevalle	*Caranx* spp.
Awal	Hammerhead shark	*Sphyrna zygæna* (Linnæus).
Bagaong	Theraponid	*Therapon* spp.
Bakoko	Fresh-water porgy	*Sparus berda* (Forskål).
Balanak	Mullet (small size)	*Mugil* spp.
Balisokan	Sergeant fish	*Rachycentron canadus* (Linnæus).
Bangkolis	Tuna	Thunnidæ.
Banogon	Spotted eagle ray	*Aëtobatus narinari* (Euphrasen).
Barorog	Slipmouth	*Leiognathus equulus* (Forskål).
Barira	Silver-bar fish	*Chirocentrus dorab* (Forskål).
Bilong-bilong	Wily slipmouth	*Leiognathus insidiator* (Bloch).
Bolgan	Sea bass	*Lates calcarifer* (Bloch).
Bolinao	Transparent herring	*Clupeoides lile* (Cuvier and Valenciennes).
Bongalonon	Sharp-nosed shark	*Scoliodon palassorah* (Cuvier).
Borirawan	Moray	Murænidæ.
Buca dulce	Threadfin	Polynemidæ.
Bugiw	Half-beak	Hemiramphidæ.
Bulan-bulan	Tarpon	*Megalops cyprinoides* (Broussonet).
Burao	Striped mackerel	*Rastrelliger chrysozonus* (Rüppell).
Buroy	Halfbeak	*Hemiramphus far* (Forskål).
Damos	Lactarid	*Lactarius lactarius* (Bloch and Schneider).
Dapak	Red snapper	*Lutjanus malabaricus* (Schneider).
Daragon	Blue-spotted sting ray	*Dasyatis kuhlii* (Müller and Henle).
Dilis	Anchovies	*Stolephorus commersonii* Lacépède.
Do-al	Garfish	Belonidæ.
I-ito	Sea catfish	Plotosidæ.
Itang	Flathead	*Platycephalus* spp.
Kabalyas	Short-bodied mackerel	*Rastrelliger brachysomus* (Bleeker).
Kabasi	Short-finned gizzard shad	*Anodontostoma chacunda* (Hamilton-Buchanan).
Kikiro	Spadefish	*Scatophagus argus* (Linnæus).
Kini	Remora	*Echeneis naucrates* (Linnæus).
Kiskisan	Spotted pomadasid	*Pomadasys hasta* (Bloch).
Koron-koron	Four-lined theraponid	*Pelates quadrilineatus* (Bloch).
Kowa-kowa	Small-mouthed threadfin	*Polynemus microstoma* (Bleeker).
Krosan	Hammer-head shark	Sphyrnidæ.
Langkoy	Cutlass fish	*Trichiurus haumela* (Forskål).
Laolao	Fimbriated herring	*Sardinella fimbriata* (Cuvier and Valenciennes).
Lapis	Leatherjacket	*Scomberoides lysan* (Forskål).
Lapo-lapo	Groupers	Serranidæ.
Lawihan	Threadfish	*Alectis* sp.
Lawi-lawi	——do——	*Alectis indicus* (Rüppell).
Lison	Banded cavalla	*Caranx sexfasciatus* (Quoy and Gaimard).
Lodlod	Black-finned shark	*Carcharinus melanopterus* (Quoy and Gaimard).
Malagapas	Spotted mojarras	*Gerres filamentosus* Cuvier.
Mamsa	Cavalla	*Caranx* spp.
Managat	Red snapper	*Lutjanus* sp.
Matang baka	Big-eyed scad	*Caranx crumenophthalmus* (Bloch).
Milipili	Theraponid	*Therapon* spp.

TABLE 2.—*Commercial species of fishes caught in San Miguel Bay*—Ctd.

Bicol name (San Miguel Bay).	English common name.	Scientific name.
Motomot	Banded slipmouth	*Leiognathus fasciatus* Lacépéde.
Nabilan	Thick-lipped grunt	*Plectorhinchus* spp.
Obod	Piko eel	*Muræsox cinereus* (Forskål).
Ogaog	Cow-nosed ray	*Phinoptera javanica* Müller and Henle.
Osoos	Whiting	Sillaginidæ.
Pagi	Rays	Batoidei.
Pagotpot	Whiskered croaker	*Sciæna* spp.
Pakan	Hardtail	*Megalaspis cordyla* (Linnæus).
Palad	Flatfishes	Heterosomata.
Pampano	Pomfret	*Stromateus niger* (Bloch).
Paras	Leaffish	*Platax orbicularis* (Forskål).
Pating	Sharks	Elasmobranchii.
Pirak-pirak	Spotted slipmouth	*Leiognathus ruconius* (Hamilton-Buchanan).
Pogapo	Grouper	Serranidæ.
Ponicon	Sea catfish	*Arius* spp.
Rayado	Bonitos	*Auxis* spp.
Riring	Drepane	*Drepane punctata* (Linnæus).
Rompe	Barracuda (large)	*Sphyraena* spp.
Salay-salay	Deep-bodied crevalle	*Caranx kalla* Cuvier and Valenciennes.
Saminayon	Yellow-striped goatfish	*Upeneoides sulphureus* (Cuvier and Valenciennes).
Sarañgan	Devil ray	*Mobula* spp.
Siliw	Flying fish	*Cypselurus* spp.
Sorodan	Sawfish	*Pristis* spp.
Suagan	Long-finned gizzard shad	*Nematalosa nasus* (Bloch).
Tabal-tabal	Banded pomadasid	*Pomadasys maculatus* (Bloch).
Tabañgoñgo	Sea catfish	*Arius leiotetocephalus* Bleeker.
Tabaroyan	Yellow-striped crevalle	*Caranx leptolepis* Cuvier and Valenciennes.
Taligmanok	Spotted eagle ray	*Aëtobatus narinari* (Euphrasen).
Talotoon	Deep-bodied pristipomid	*Pristipomoides* sp.
Tamban kabasi-on	Deep-bodied herring	*Sardinella perforata* (Cantor).
Tangigi	Spanish mackerel	*Cybium commerson* (Lacépéde).
Tarakitok	Cavalla (large)	*Caranx* spp.
Tayotos	Whiting	Sillaginidæ.
Tegui	Deep-bodied anchovy	*Scutengraulis* sp.
Tingarog	Flame-colored snapper	*Lutjanus fulvus* (Bloch and Schneider).
Titso	Barracuda (small size)	Sphyrænidæ.
Toros	Siganid	*Teuthis javus* Linnæus.
Turiñgan	Bonito and tuna	Thunnidæ.
	SHELLFISHES	
Balao	Tiny shrimp	*Palæmonetes.*
Kanoos	Squid	Decapoda.
Kapis	Window shell	*Placuna placenta* Linnæus.
Kasag	Crab	*Neptunus pelagicus* Linnæus.
Pasayan	Shrimps	*Penæus* spp.

consists in submerged resources rather than in abundance of the pelagic migratory species that appear in vast schools and are caught at definite seasons of the year. This region is an abode of "ground" species, which frequent muddy bottoms and derive

most of their food from the enormous quantities of plankton life carried with the sediment of the large rivers that empty into the bay. Thus it has been observed that after heavy rains the fish corrals set nearer the shore make better and larger hauls than those constructed in the deeper waters. Even the trawls which always fish in the deeper waters of the bay are ineffective in the capture of such shore-feeding species as the shrimps and the sea catfishes. Evidently these fishes are nearer the shore during this time for feeding purposes.

Table 2 is an alphabetical list of the different species observed in varying quantities in the catches of the different gear in use in San Miguel Bay, together with their local names. Due to the influence of fishermen that came from Manila Bay, some fishes are known by two names—the San Miguel Bay Bicol and the Manila Bay Tagalog.

FISHING METHODS

As in other fishing centers in the Philippines, the methods of fishing employed in San Miguel Bay are varied and numerous, ranging from the simple way of catching fish by the use of hook and line with or without the use of banca and light, to the more modern beam trawling involving the use of a motor boat of more than three tons gross. Because of the nature of the sea bottom in this region and the fact that the major resources consist of submerged species, the fishing appliances used are designed and constructed largely for the catching of so-called "ground" fishes.

As many fishermen from Manila Bay, mostly from Rizal Province, are operating in San Miguel Bay, the majority of the fishing gear used more or less resemble or are identical with gear used in Manila Bay. The fishermen from Manila Bay have brought with them their methods of fishing, which, with the exception of the beam trawl, have been adopted by the Bicol fishermen, who are now employing them with skill and ease.

Japanese beam trawl.—From the point of view of volume of catch, the beam trawl is the most important fishing method in use. Having been operated here for barely a year's time, this gear has met with stiff opposition from the native fishermen and the local authorities. Two petitions were forwarded, one to the President of the Commonwealth of the Philippines and the other to the Secretary of Agriculture and Commerce. An investigation of this gear was conducted by the writer, the results of which are given below.

These beam trawlers are operated in the deeper waters of the bay, in the neighborhood of the mouth of Bicol river, in depths ranging from 6 to 17 fathoms, toward the western coast during the southwest monsoon and toward the eastern coast during the northeast monsoon.

The description of the make and the mode of operation were published in a previous paper.[1]

The three trawlers with Sibobo, Calabanga, as their home port start for the fishing ground between 7 and 8 A. M., after receiving their provision, fuel for the engine, and ice for the catch. They reach the fishing ground at about 11 A. M. when the trawl net is shot for the first time. It is then towed until about 2:30 P. M., when the first haul is made. If the conditions of the current do not change, the second shooting occurs about 3 P. M., after the catch of the first haul is sorted and stored, and when the approximate point of the start of the first towing is reached. The net is again towed until about 7 P. M. when it is hauled for the second time. The third shooting takes place at about 8 P. M., and the net towed until about 2 A. M., when the third and last haul is made. The trawlers (only three were operating in San Miguel Bay during the investigation in 1936,—"Lubang III," "Lubang V," and "Mabuhay A") then start on their homeward trip to Sibobo, where they arrive between 4 and 5 A. M.

Aboard the trawlers the Filipino middlemen purchase the catches and take them by truck to Naga. The large-sized specimens are packed in boxes with ice and shipped to Manila by rail, while the smaller fishes are sold to retailers for marketing in the local fresh-fish markets. The wholesale prices paid by these middlemen are definite for each of the major species that compose the catch. The unit measure used in these wholesale transactions is the kerosene box (case containing 2 kerosene cans of about 5 gallons each), which, when it is filled with fish, weighs approximately 25 kilograms on the average.

PRICES FOR EACH OF THE SPECIES MOST FREQUENTLY CAUGHT IN QUANTITIES BY THE TRAWLERS IN SAN MIGUEL BAY

Kind of fish.	Price per 25 kilograms. Pesos.
Kiskisan	3.00
Abo	2.00–2.20
Pagotpot	0.80–0.90
Pasayan	4.00–4.50

[1] Philip. Journ. Sci. 48 (1932) 389–410.

The grounds being extremely shallow and not far from the home port or base, a trawler with a Japanese engine of more than 40 h. p. is expensive and unnecessary. The trawlers operating in San Miguel Bay are all steered from a wheelhouse.

The following is an itemized list of expenses involved in the capitalization of one of the trawlers, the "Mabuhay A" (12.48 gross tons capacity), operating in San Miguel Bay, as furnished by Mr. Uehara:

	Pesos.
Vessel (Sampan type)	3,500
Engine (40 h. p. Japanese make at 70 pesos per h. p.)	2,800
Three trawl nets at 250 pesos per net	750
Winch	200
Warps (wire and hemp)	100
Iron chains (200 kg at 0.15 pesos per kg)	30
Glass floats (100 at 0.10 peso per float)	10
Stone weights (60 at 0.15 peso per weight)	9
Total	7,399

The catch of the trawlers in San Miguel Bay is very different from those of other trawling grounds—Manila Bay, Lingayen Gulf, and Ragay Gulf—in that the bulk consists of fewer species. The kiskisan are caught in moderate or large sizes and the abo, not found in other trawling grounds in the Islands so far exploited, is present in great quantities. The shrimps appear in small and moderate sizes, none of the large ones common in Ragay Gulf being included in the catch.

Fish corrals (*sagkad*).—Of the different native devices of fishing in use here, the fish corrals, locally known as *sagkad*, are the most important and numerous, literally dotting the shores along the western and southern coasts during the southwest monsoon and along the eastern coast during the northeast monsoon. Various sizes, styles, and shapes set in varying depths of water are seen in this region, some of them native or local styles and others introduced by the fishermen of Manila Bay.

For shallow waters, they have the *pamasayan*, and as the name signifies, is used for the catching of *pasayan* or shrimps. This device is either of the natural or of the *toris* type, set in depths up to 7 feet, and necessitates an investment of about 100 pesos. Text figs. 1 and 2 are the ground plans of the 2 types of pamasayan used in this region. As has been previously stated, the catch consists mostly of shrimps of different species and of various sizes, together with limited amounts of small-sized fishes found not far from the shore.

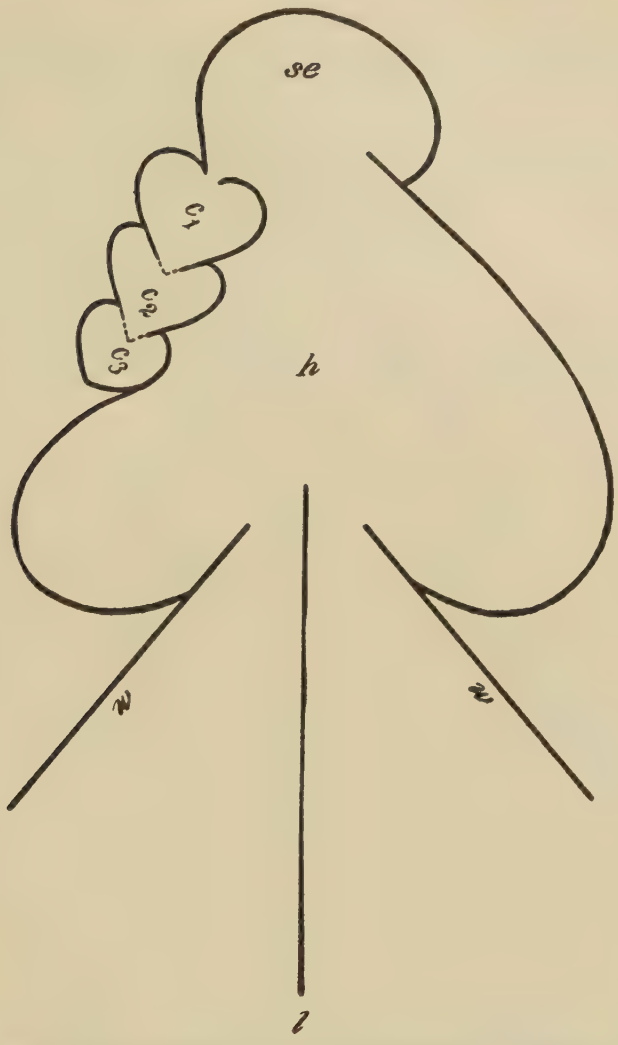

FIG. 1. Pamasayan (shallow-water fish corral) of the natural type; diagrammatic. *l*, Leader; *w*, wings; *h*, heart; *se*, semicircular enclosure; *c*1, *c*2, *c*3, cribs or pounds.

Text fig. 3 is the ground plan of the *sabay,* a local movable shallow-water fish weir that is transferred from place to place as the conditions for good fishing demand. The gear consists of long, but low, split-bamboo mattings supported on poles and set parallel to the coastline just before ebbtide. It is about 800 feet long and about 4 feet deep.

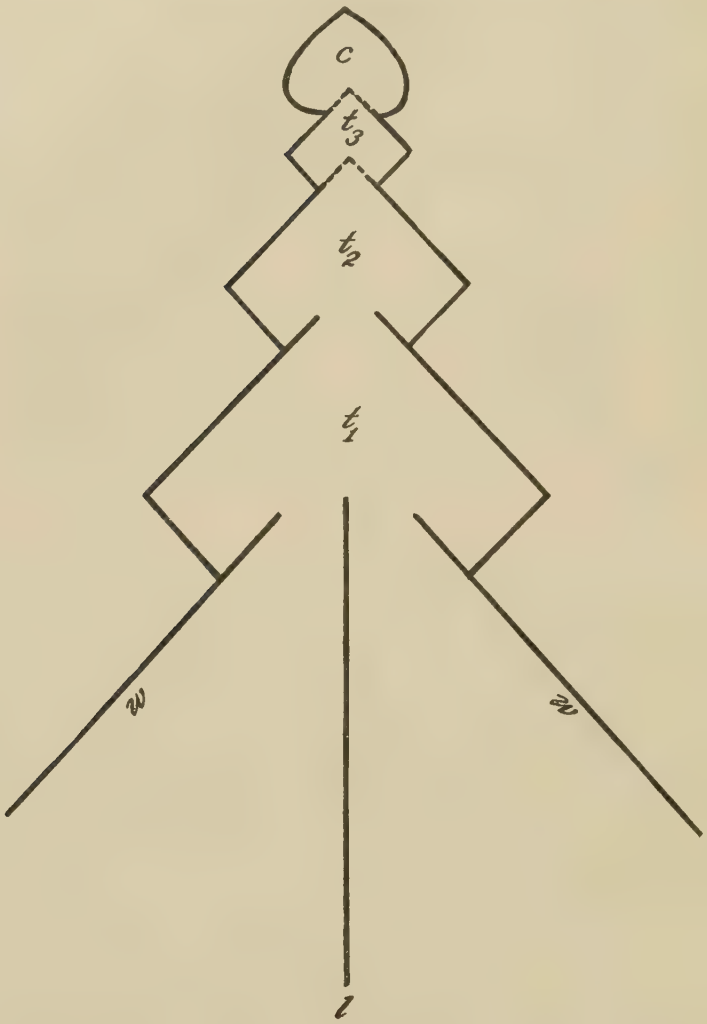

FIG. 2. Pamasayan of the toris type; diagrammatic. *l*, Leader; *w*, wings; t_1, t_2, t_3, triangular compartments; *c*, crib or pound.

FIG. 3. Sabay, a transitory fish weir; diagrammatic. *w*, Wing; c_1, c_2, cribs or pounds; b_1, b_2, attending bancas.

With the ebbtide, small-sized mullets and shrimps brought by the flood are caught and impounded in the small terminal crib, c_2, as the water recedes. From here the catch is collected by means of dip nets into the bancas, b_1 and b_2.

After brailing out the catch, the whole apparatus is removed to be set in some convenient and profitable site before the next ebb, when the whole operation is repeated.

This fishing device necessitates the investment of about 200 pesos and requires 5 men to operate.

Text fig. 4 is the ground plan of the deep-water fish corral, known in the San Miguel Bay region as the *quinavite,* because Cavite fishermen are supposed to have introduced it there. In

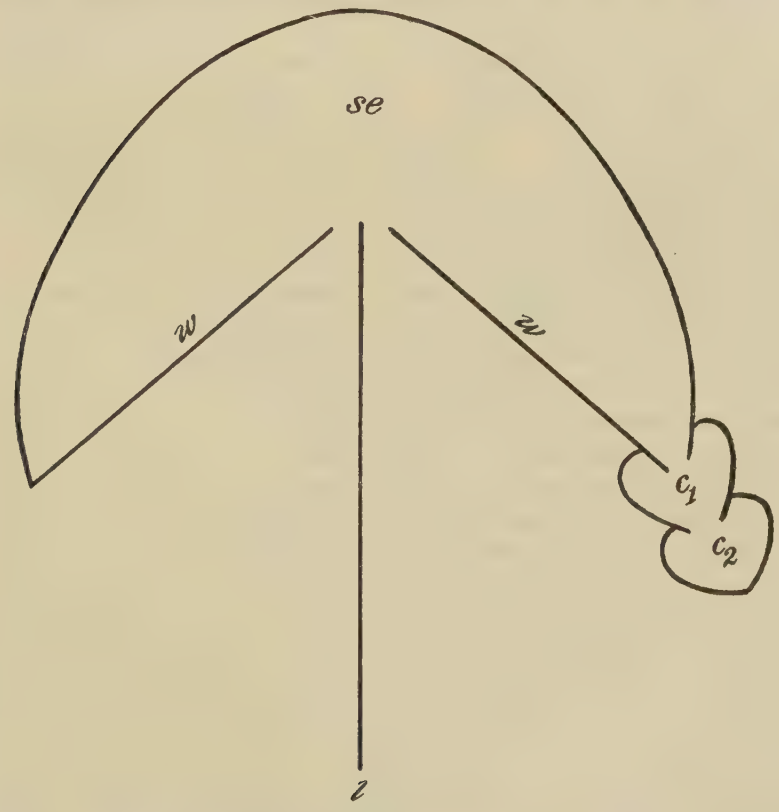

FIG. 4. Quinavite (deep-water fish corral); diagrammatic. *l*, Leader; *w*, wings; *se*, semicircular enclosure; c_1, c_2, cribs or pounds.

fact, as previously stated, many of the fish corral owners and operators in this region came from Manila Bay and have become permanent residents of this place.

This type of fish corral is generally set in waters ranging from 3 to 7 fathoms in depth, and necessitates the investment of from 400 to 600 pesos. The *siguin* (a drag net with purse rings) is usually employed in the collection of the catch. The catch consists of the large-sized pomadasids, cavallas, sea catfishes, and sharks, and the smaller pelagic species, like the mackerels and the deep-bodied herrings. During the period of investigation, (1936) with the southwestern monsoon prevailing, the fish weirs constructed in comparatively shallower waters were observed to have made greater and larger catches of sea catfishes and cavallas—a phenomenon which seems to signify that during the rainy season the vast quantities of nitrogenous matter and plankton carried by the rivers are responsible for the congregation of more fishes nearer the shore for feeding purposes.

Kubkub.—The kubkub in this region is different from the purse seine of the Tagalogs. In San Miguel Bay it is not exactly a purse seine. It is commonly employed in the catching of demersal species, such as the spotted pomadasids (kiskisan) and the sea catfishes (tabañgoñgo). Although used without light, it is operated only in the dark of the moon, apparently to prevent the fishes from being scared by the netting.

Text fig. 5 is a diagrammatic presentation of its operation. The gear itself consists of two sets of nets—an outer curtainlike impounding net of variable length and of any size of twine and width of mesh for surrounding or impounding the school, and an inner pursing net generally consisting of two pieces of siguin (fish-corral drag seine) joined together. The inner net is a brailing net operated in much the same way as in the deep-water fish corral, being dragged from one side of the pound to the other and the bottom line being pursed as the opposite side is reached, where the catch is brailed into the attending banca.

A submerged school of demersal fishes is first located by the luminescense of the water. It is then surrounded by the first or outer net which hangs to the bottom of the sea like a curtain. The pursing net is then paid out inside the first netting and dragged from one side to the other of the impounding net, as in seining a deep-water fish corral, and its bottom line pursed. Hence the second or inner net serves the purpose of an auxiliary pursing net which becomes a huge dip net when thus pursed for the brailing of the catch. The catch are generally only the large-sized kiskisan and tabañgoñgo.

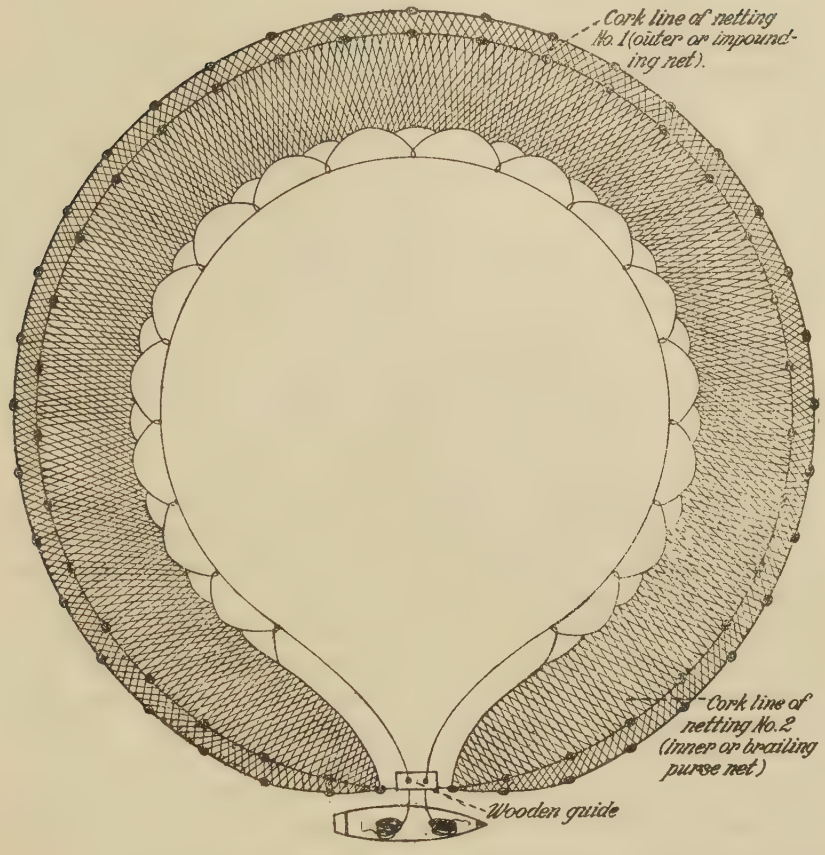

FIG. 5. Kubkub in operation; diagrammatic.

One outfit of this gear necessitates the employment of over 30 men in its operation and requires the investment of about 600 pesos.

Hook-and-line fishing.—Although quite an antiquated fishing gear, the hook and line used in various ways is of commercial importance in this region because of the great number of hand liners. They thus bring to the market a considerable quantity of fish when their catch is considered as an aggregate haul.

With neither banca nor light, fishing is done in wharves or in some convenient steep-to places where the lines can be easily played.

When a banca is employed and in daytime fishing, the lines are cast from a boat some distance from the shore, where fishes (usually abo and osoos) bite freely. As many as 50 handline

fishing bancas in limited areas where fishes abound are not an uncommon sight off the barrios of Bito and Cagliliog.

When fishing is done at night during the dark of the moon, light is employed, not for actual fishing for the large-sized game fishes, but for attracting the smaller pelagic species upon which the former prey. The presence of these smaller fishes serves to attract the larger species sought after, and fishing is done in the manner of chumming. The kerosene lamps used are of several makes, among them Coleman, Petromax, and Standard, and of varying intensity. The aggregate catch of the great number of fishermen operating with hook and line and light is enormous, and certainly to be reckoned with in the fresh-fish supply. This type of hook-and-line fishing is especially common in Tandoc, the catch contributing considerably to the supply sent in ice from Naga to Manila by rail.

To some extent *quitang* (trawl line) and *sibid-sibid* (trolling) are employed for the catching of such pelagic game fishes as the tangigi (Spanish mackerel), the turiñgan (tuna), the rompe (barracauda), and the lison (cavallas).

Palubug or patalang.—This gear is also commonly employed by the native fishermen. It is a gill net similar to the *bating* of the Tagalog fishermen, both in make and in the mode of operation, save that the former is slightly smaller and made of different sizes of netting, depending upon the species sought after.

Table 3 is a comparative list of the different kinds of palubog employed in this region, the kinds of netting used, and the species of fish caught.

TABLE 3.—*Types of palubog used in San Miguel Bay and the fishes caught by them.*

Name of gear.	Netting used.		Species caught.
	Mesh.	Twine [a] No.	
	Inches.		
Palubog sa balanak	1¼	40	Mullet.
Palubog sa tamban	1½	27	Deep-bodied herring.
Palubog sa lawihan	2	31	Long-finned gizzard shad.
Palubog sa kabasi	2	5	Short-finned gizzard shad.
Palubog sa kiskisan	4	2 or 5	Spotted pomadasid.
Palubog sa tabañgoñgo	4	30	Sea catfish.

[a] The sizes of the twines adopted are arbitrary numbers used in the catalog of L. R. Aguinaldo for 1935.

The net with wooden floats on the cork line and lead weights on the bottom line is composed of several separate rectangular pieces that are joined together in the actual fishing operation to produce a net of considerable length. Each piece is about 1,500 meshes long and about 10 feet deep.

It is carried on board a banca. When a school of fish is sighted, the net is paid out in such a way as to describe a circle enclosing and impounding the fishes. The banca then enters the inclosure and the fishermen scare the impounded fishes into the meshes of the net by beating the water and by making all sorts of disturbance. Once the fish are gilled, the net is hauled in, and the fishes are picked one by one from the meshes.

Sarap.—The sarap is a small shore seine of sinamay or abacá cloth. Its length and depth vary with the species for which it is designed. Two kinds of sarap are commonly used in this region. One is the *pamalao,* used in catching tiny shrimps (balao) and usually equipped with a bag of from 10 to 15 feet, and wings of about the same length and about 3 feet deep. The other, designed for the capture of balanak or mullet, is a slightly larger sarap, locally known as *sarap sa balanak.*

The cork and ground lines, together with the ends of the two wings, are selvaged with wider meshes of ¼-inch hand-knit abacá twines. The free ends of the wings are each provided with bamboo or wooden brails about 3 feet high, to each of which a short bridle is attached. The pull or hauling ropes are in turn attached to these wing bridles. Most often, however, these brails serve as handles by which the two men operating the net drag it along the shore.

Aboy bating.—This gear is not identical to the bating used by the fishermen of Manila Bay. Its name is rather a misnomer, for in reality it is more similar to what is known to the Tagalog fishermen as *pangtukos,* a trap net provided with two wings and a landing bag or bunt at the center.

The net itself, which is rectangular in shape, is made of either No. 25 or No. 28 cotton web at the wings and of No. 43 at the bunt. It is from about 80 to 100 feet long and from about 25 to 40 feet deep. It is carried in two large bancas escorted by several (from two to twenty) smaller bancas. Its operation is also confined to the dark of the moon, although it is sometimes operated in the daytime for the capture of balanak, in which case it resembles the *katigbi* of the Tagalog fishermen.

When a school of fish, usually herring fry, is sighted, the net is paid out by the two large bancas. Upon a given signal from these large bancas, the smaller bancas, manned by one or two men, align themselves into an arc some distance from where the net has been set. They then scare the fishes into the set net by creating all sorts of disturbance in the water, thus forming a cordon of escorts driving the fishes into the bunt of the net. By means of two ropes attached to the ends, the lead line is then hauled from the two large bancas. Text fig. 6 is a diagrammatic sketch of the arrangement of the net and the bancas during the fishing operation.

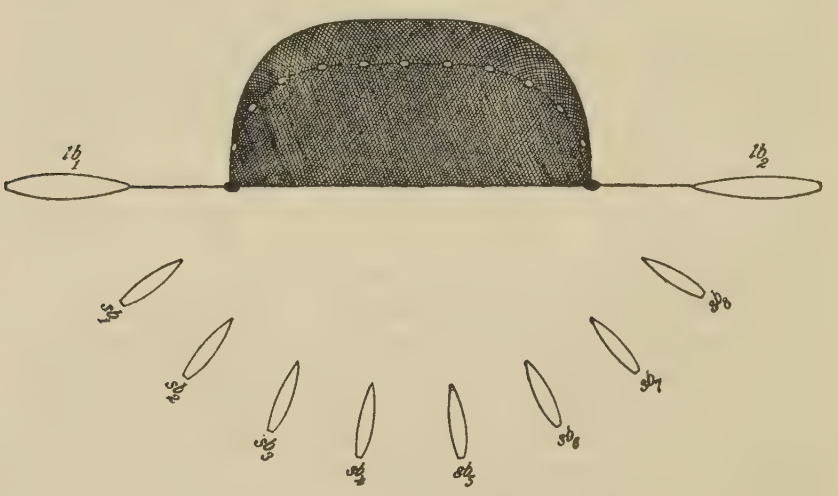

FIG. 6. Aboy bating in operation; diagrammatic. *lb*1, *lb*2, Large bancas; *sb*1, *sb*2, *sb*3 *sb*4, *sb*5, *sb*6, *sb*7, *sb*8, small bancas.

The catch consists exclusively of herring fry. The whole outfit is manned by about 50 men in actual fishing.

Panglambang.—This floating gill net for the catching of herring was only recently introduced in this region by the Navotas fishermen. Although the type used in San Miguel Bay is smaller than that used in Manila Bay, the make and mode of operation is the same. This gear resembles the true bating, except that the meshes are strung vertically in relation to the cork and bottom lines.

The net proper is composed of twelve pieces which are joined together during actual fishing. Each piece is 18 fathoms long and 13 fathoms deep. The body of the net is of No. 40 cotton twine webbed with a mesh of 1 inch stretched. The side selvage consists of 8 meshes of No. 18 twine webbed with a

mesh of 1 inch stretched, while those of the cork and bottom lines are of 8 and 13 guarding meshes, respectively, made of No. 18 twine that is webbed with a mesh of 1 inch stretched. The wooden floats on the cork line and the lead weights on the bottom line are attached and strung at intervals of 1 foot.

This gear is usually operated during the daytime, in connection with one or more boats, generally with two. The fishing boats leave port for the fishing grounds early in the morning and return late in the afternoon. When they arrive in the fishing grounds, they begin to search for a school of herring (usually adults). Experienced fishermen detect a floating school by the flipping movements of the fish on the surface of the water, the ripples caused by such disturbances even enabling an expert to determine the size of the fishes. A submerged school can be detected by an expert fisherman by the sound caused by the activity of the fish, that is, by the "feel" of the water. The presence of gulls in the vicinity signifies the prevalence of herrings.

When a floating school is sighted, the two bancas with a net in each pay out their respective nets, describing a half circle in this laying process (text fig. 7*a*), each dropping their starting buoys, sb_1 and sb_2 and setting the first portion of the net seaward. The net is paid out in this manner in order to check the escape of the fishes in that direction, the natural course followed by them when frightened. Both bancas meet at a shoreward point, dropping their terminal buoys, tb_1 and tb_2, and thus enclosing the school. The two bancas are then rowed inside the inclosure and by the beating of bamboos on their holds and by making all sorts of noises in the air and commotions in the water with the aid of a wooden plunger (text fig. 8*c*) the fish are scared into the meshes. The course followed by the bancas is shown in text fig. 7 by dotted lines. The nets are then hauled in from the terminal buoys and the fish picked from the meshes. The nets are then piled carefully on board, and when another school is located the entire operation is repeated.

When a submerged school is observed by a boat operating singly, the net is first paid out at the starting buoy (text fig. 7*b*, *sb*), whence a sort of a crib is traced; then the boat proceeds in such a manner as to describe an arc parallel to the shore and seaward from the starting buoy. At the opposite end of the net another crib is formed, and a terminal buoy, *tb*, is lowered. The boat then cruises as indicated by the dotted line in text fig. 7, and by means of the same devices mentioned in the above dis-

cussion the fishes are driven into the meshes of the net. The net is then hauled in, the hauling process commencing at the terminal buoy and terminating at the starting buoy. The fishes are then picked from the meshes of the net.

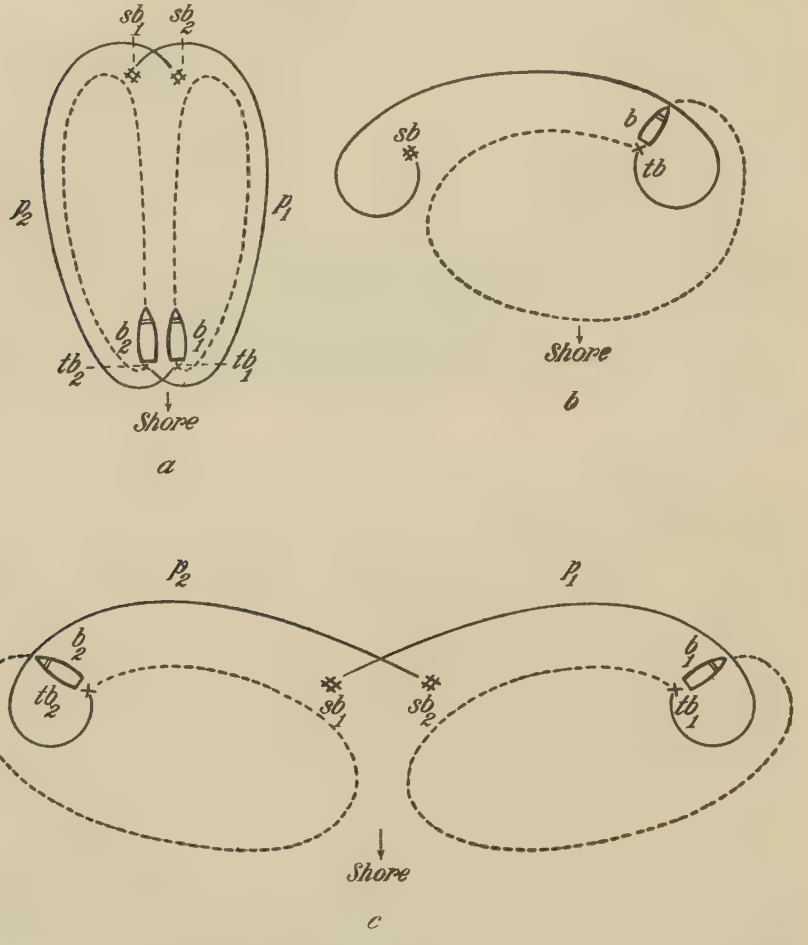

FIG. 7. Different ways of paying out the panglambang; diagrammatic. *a*, Operating in pairs and enclosing a floating school; *b*, operating individually; *c*, operating in pairs and enclosing a submerged school; sb_1, starting buoy of outfit No. 1; sb_2, starting buoy of outfit No. 2; p_1, panglambang of outfit No. 1; p_2, panglambang of outfit No. 2; tb_1, terminal buoy of outfit No. 1; tb_2, terminal buoy of outfit No. 2; b_1, banca of outfit No. 1; b_2, banca of outfit No. 2.

In operating in pairs and in fishing for a submerged school, the procedure in laying out the net is shown in text fig. 7*c*; the course followed by the boats in scaring the fishes is indicated by the dotted line.

A fishing crew operating a single boat consists of 12 men, while a crew operating a pair of boats consists of at least 24 men. The catch consists mostly of deep-bodied herring together with limited quantities of crabs, squids, gizzard shads, and halfbeaks accidentally gilled.

CAPITAL REQUIRED FOR THE EQUIPMENT OF A BOAT OPERATING SINGLY.

	Pesos.
Boat (banca)	500
Net	500
Total	1,000

Sapiao.—This gear is entirely different from the common sapiao used in the catching of pelagic species, such as anchovies and herring. As observed in the barrio of Bagacay, Tinambac, it consists of a triangular net mounted on two bamboo cross pieces; the whole appliance in turn is mounted on a banca. Text fig. 9 is a diagrammatic sketch of this gear.

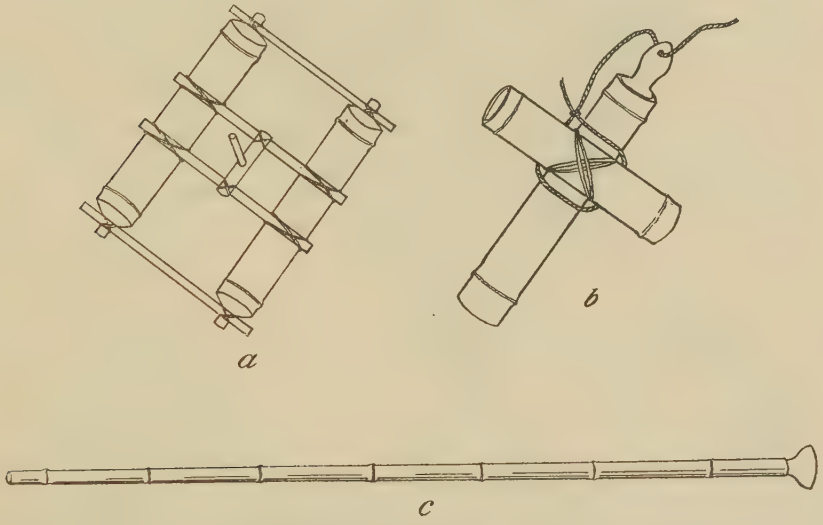

FIG. 8. Accessories of a panglambang outfit. *a*, Starting buoy; *b*, terminal buoy; *c*, panglurok, a wooden plunger.

The net itself is of Number 40 cotton thread with a square mesh of about ½ inch. It is about 25 feet wide at the base of the supposedly triangular net and has an altitude corresponding to the full length of the two bamboo cross pieces.

The mounted net is towed parallel to the shoreline on a banca by two men who also lower and raise the net. When schools of

mullet are seen, the net is lowered by tilting the banca to one side. From a distance of about 60 feet two other men begin to drag a scare line (abaca rope with pieces of coconut husk strung at regular intervals) about 60 feet long. The mullet, upon being scared, jump until they are driven into the submerged net, and the two men supporting it begin to raise it above the surface of the water where the catch is collected.

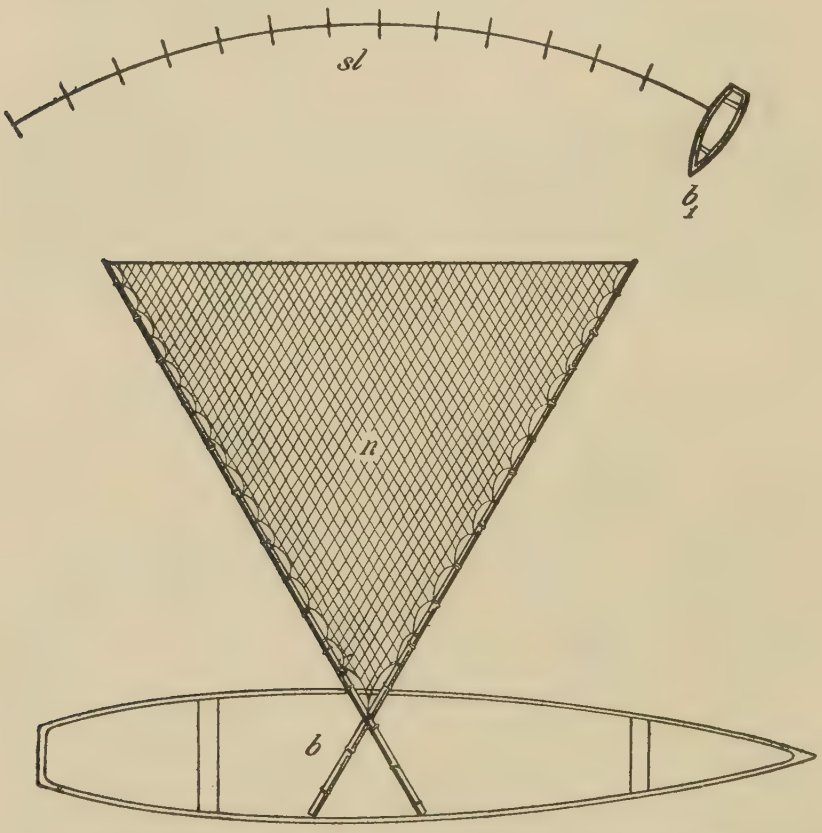

FIG. 9. The sapiao in operation; diagrammatic. *b*, Banca to which net is attached; *n*, net; *sl*, scareline; b_1, attending banca.

Other fishing gear of rather less importance, operated in almost the same manner as in Manila Bay and described in various papers on Philippine fishing methods, are the *pante* (gill net for crabs), the *largarete* (gill net for herring), the *hodhod* or *sakag* (collapsible triangular dip net), the *chinchorro* (beach seine), the *laya* (cast net), the *bobo* (bamboo fish basket or trap), and the *bintol* (trap net for crabs).

FISH-PRESERVATION METHODS

As more or less adequate icing facilities and fairly regular means of transportation in the form of railroads and trucks are available, a great volume of the catch is marketed in the fresh state in Manila. The curing of fish by salting, drying, and, to a limited extent, smoking is confined to the small and medium-sized species and to larger sizes that are left unsold in the fresh-fish market of Naga.

Refrigeration.—The refrigeration method employed is direct icing, a temporary method of preserving the catch so that it can be shipped to richer markets in cities where it is sold at much higher prices than those obtaining locally. During the height of the fishing season in San Miguel Bay, four icing establishments were observed in Naga, with a daily shipment of no less than from 1 to 2 tons of fish of the larger and first-class species.

The business consists in the wholesale buying of the catches of the fishermen, icing them, and shipping them to Manila. Ice is supplied by either the Camarines Sur Industry plant located at Magarao or by the Meralco Ice Plant situated in the town of Naga.

The catches of large and desirable species are bought by the middlemen from the individual fishermen. They are then resold to any of the four icing establishments. The following are the quotations for the various species with station or delivery at Naga:

Kind of fish.	Price per kg. Pesos.
Kiskisan	0.15 to 0.17
Lapu-lapu	0.30
Tiñgarog	0.20
Kanoos	0.20
Pasayan	0.22

These fishes are packed in fish boxes (one box has an approximate capacity of 100 kilograms) with alternate layers of crushed ice, the sides and the top being covered with several layers of banana leaves before the wooden cover is put in place. These boxes are then shipped to Manila by either the 11:00 A. M. or the 3:10 P. M. trip of the Manila Railroad.

Drying.—Drying is done especially when there is plenty of sunshine. The small fishes, such as the dilis, bolinao, and siliñasi, are dried without the preliminary brining process. The moderate-sized species, such as the pagotpot, abo, tamban ka-

basi-on, balanak, kabasi, and the small tabañgoñgo, are immersed in brining tanks in the round for about 12 hours, after which they are allowed to drain. They are then spread on platforms to dry thoroughly in the sun. During extremely rainy days, when the air becomes very moist, they are salted individually before being dried in the sun.

The larger-sized individuals, such as the large abo, tabañgoñgo, kiskisan, and kabalyas, are first split and eviscerated before they undergo the brining process. They are then dried thoroughly in the sun.

Salting.—*Bagoong* and *boro* making are the two genuine salting processes in vogue in this region.

In the making of *bagoong,* either the fry of herring (siliñasi) or the tiny shrimps (balao) are used. The process employed is identical with the method followed in other fishing centers, like Manila Bay, Carigara Bay, and Balayan Bay.

In the manufacture of *boro,* either the tamban, the dilis, or the bolinao is used. The fish are first immersed in concentrated brine solution for 12 hours, after which they are allowed to drain overnight. The following morning they are salted with coarse dry salt, and marketed dry in this state with crystals of the preserving material.

Smoking.—To some extent, large rays are cut into strips and smoked over elevated platforms in the manner of making coprax by the "tapahan" method.

Preservation of shrimps.—Because of the abundance of shrimps in this region, several methods of preserving them have been evolved and are being employed on a commercial scale, some of them observed only in this region. The resulting preserved products are *bagoong, hibe,* and *dinailan.*

The manufacture of bagoong has been discussed above. Hibe is made as follows: To 1 "kawa" of water, 6 liters of salt is added. The mixture is heated and the medium-sized shrimps are boiled until they turn red. They are then drained and dried, after which they are placed in sacks. By beating the sack containing the boiled shrimps against any hard object (a post for instance) the flesh is freed of the exoskeleton. By shifting, the finished product is separated from the waste material, and is then ready for the market.

The preparation of *dinailan* consists in the drying of the tiny shrimps on elevated platforms in the sun for about one day. These semidried products are then ground or pounded as fine

as possible. Then the partially solidified product is dried for another day, after which it is ground or pounded for the second time with the resulting very fine and almost homogeneous product or paste, although still somewhat wet. This is dried for the third time after which it is finally shaped into cylindrical bars about 2 inches in diameter and about 1 foot long. In this shape and state, it is sold in the market.

The Bicolanos relish this preparation which they cook with various kinds of vegetables.

FISHERY LEGISLATION AND ITS ADMINISTRATION

As in most fishing centers in the Islands, local fishery legislation in this region has one purpose—the collection of as much revenue as possible in order to swell the municipal funds for the support of the local government without due consideration for the poor fishermen that have to shoulder the burden. More often than not, legislation has the sole or principal objective of imposing as high taxes and fees as possible, usually prohibitive, with no attention paid to the question of preservation and conservation of the fisheries for future generations. In some instances, provisions of the municipal ordinances relating to fishery are restrictions placed upon introduced, but legitimate, fishing appliances, with the aim of actually prohibiting and sometimes expressly outlawing them, with no scientific basis whatsoever for such action but merely for the purpose of protecting the interest of a group or groups of fishers.

Varied conflicts have been registered due to faulty legislation, containing provisions not in accordance with those of the Fisheries Act. These differences were not only between commercial or insular and municipal operators but also among the local fishers themselves—Tagalog versus Bicol and Bicol versus Bicol. One of the serious outrages committed by the native fishermen that came to the knowledge of the writer was the case of a fisherman from Manila Bay who suffered physical injuries at the hands of some notorious Bicol fishermen who took the law into their hands for the settlement of differences in their fishing interests.

A very recent conflict is evidenced in two petitions of fish-corral owners against the operation of the beam trawl. An investigation was personally conducted by the writer, the results of which are cited in the following paragraphs.

The petitions mentioned above were motivated by reasons similar to those that prompted the fishermen of Manila Bay to question the operation of the trawlers during the early days of the latter's activities there. The fishermen here, just like those of Manila Bay, object to the operation of this modern gear, not because it has been proven destructive to the fishery resources, but because it is far superior and more effective than the gear in vogue in this region. In the strict sense, the petitions do not concern the fishing appliance proper, but are directed towards the strong competition offered by the trawlers to the fish-corral owners, the latter being the most important device used by native fishermen here. Any new fishing device other than the beam trawl would have met the same opposition in this region.

As has been the case in Manila Bay, and in Lingayen Gulf, the beam trawl in San Miguel Bay has been subjected to unfounded suspicions and destructive criticism for no other reason than its novelty and its foreign origin. Such opposition is always encountered by any new method of fishing employed for the first time in a locality, not only in the Philippines but also in foreign countries. To quote J. B. Philips [2] "the introduction of any new form of fishing gear which profoundly affects a fishery is usually met with by opposition from fishermen who cannot successfully compete with their old-styled gear, and their opposition is always on the ground that the new gear is unduly destructive and will ruin the fishery."

A new gear is always considered destructive by those who have studied neither its construction nor its mode of operation, because it is more effective than the gear already in vogue. Due to the ease and the facility with which its operators capture fish, its operators are, more often than not, suspected of illegal methods. As time passes, however, and as the local fishermen become cognizant of the legitimacy and superiority of a new gear, their attitude of unreceptiveness and antagonism disappears automatically, and they emulate it rather than despise it. No better proof is worth presenting than the conditions now obtaining in Manila Bay and in Lingayen Gulf where once the same beam trawl was bitterly opposed and where it is now operating without molestation.

[2] California Fish and Game Quarterly Magazine 18 (1932) 209.

CONCLUSION AND RECOMMENDATION

1. Fishing in San Miguel Bay is profitable, for here the season is at its height during the stormy part of the year, when most of the fishing grounds in the Philippines are exposed and hence rendered barren. Consequently there is always a good market for the catch with good prices.

2. Although in some sections of the bay fishing is observed the year round, the peak of the season occurs during the southwest monsoon from May to September, when the greater portion of the coastline is least exposed.

3. Calabanga, and more specifically Barrio Sabang in the municipality of Calabanga, is the center of fishing activities around San Miguel Bay.

4. The resources of the grounds consist in enormous quantities of submerged, ground, or bottom species rather than in abundance of the pelagic migratory fishes that appear in vast schools during definite seasons of the year.

5. Although only a recently exploited trawling ground because of its limited area beam trawling operations in San Miguel Bay need to be regulated. However, such regulatory measures must be based on results of scientific investigation on the life histories of the different species that compose the bulk of the catch. On the basis of such studies and actual experimental trawling, the meshes of the cod ends or bags can be fixed in such a way that these said bags when towed will catch the maximum number of mature and marketable individuals and at the same time allow the escape of the greatest number of immature individuals. Legislation based on considerations other than technical studies will cause unnecessary waste in the utilization of these submerged resources and may finally lead to the collapse of this very profitable industry.

6. Since time immemorial various native fishing gear have been in operation in the bay with the sole aim of catching as much as possible, without thought of the conservation of the fishery. Even a superficial examination of the catch of the gear employed will reveal a very heterogenous composition, large individuals as well as small, and mature as well as immature. This indiscriminate catching of the different species has resulted in a decrease of the supply that is now beginning to be felt more acutely by the individual fishermen. The establishment of size limits for the most important species and the setting of minimum

widths of the meshes of the siguin or drag nets used in fish corrals and the bags of the seines and trawls is now of paramount importance.

7. A reform in the method of direct icing employed is essential in order that the frozen or iced fish shipped to distant markets will retain the original flavor of the freshly caught fish. This reform should involve proper care of the catch before icing, evisceration of specimens to be iced, especially the large-sized ones, and the avoidance of too much pressure on the flesh of the fishes during packing and in transit.

8. Supervision of the sanitary conditions prevailing in preservation sheds and plants, and hygienic procedure in the preparation of *tuyo, bagoong, hibe,* and *dinailan,* as well as proper care in storage, are imperative.

9. Coördination of the different local regulations relating to fisheries as provided in the different municipal ordinances is badly needed in order to avoid conflicts between the commercial or insular fishers and municipal operators, and among the local fishers themselves. Maximum limits for fees exacted of each fishing apparatus must be established in accordance with the richness of the ground and the amount of capital invested, with the insular rates as the basis. Class legislation resulting from political manipulation must be checked. All these improvements can be effected by making all such municipal ordinances subject to the approval of the Secretary of Agriculture and Commerce.

10. Since the sole interest of the local authorities is the collection of fees without regard to the conservation of fishery resources, it would be wise in the long run for the insular government to take over the control of the supervision over the municipal fisheries from the local authorities, with the provision that a certain percentage of the amount collected in fees for the privilege of fishing revert to the funds of the municipalities concerned.

ILLUSTRATIONS

PLATE 1

San Miguel Bay and its fishing areas. (Adapted from Chart No. 4223 of U. S. Coast and Geodetic Survey.)

PLATE 2

FIG. 1. Fish landing at Sabang Calabanga, San Miguel Bay.
2. Boats used by the local fishermen in the catching of fish.

PLATE 3

FIG. 1. Camarins in Sabang Calabanga used for storing nets and utilized as living quarters of fishermen.
2. Fishermen mending nets used in pelagic fishing.

PLATE 4

FIG. 1. Hauling salap sa balanak in San Miguel Bay.
2. Drying the panglambang.

PLATE 5

FIG. 1. Storing the panglambang in one of the camarins.
2. The fresh-fish market in Naga where the catches from San Miguel Bay are generally disposed of.

PLATE 6

FIG. 1. The preserved fish market in Naga where the cured products are marketed.
2. Platforms used in the drying of fish.

PLATE 7

FIG. 1. Fishing grounds for tiny shrimps (balao) in Bagacay, San Miguel Bay.
2. Catching balao by means of a small drag seine.

TEXT FIGURES

FIG. 1. Pamasayan (shallow-water fish corral) of the natural type; diagrammatic. *l*, Leader; *w*, wings; *h*, heart; *se*, semicircular enclosure; c_1, c_2, c_3, cribs or pounds.
2. Pamasayan of the toris type; diagrammatic. *l*, Leader; *w*, wings; t_1, t_2, t_3, triangular compartments; *c*, crib or pound.
3. Sabay, a transitory fish weir; diagrammatic. *w*, Wings; c_1, c_2, cribs or pounds; b_1, b_2, attending bancas.
4. Quinavite (deep-water fish corral); diagrammatic. *l*, Leader; *w*, wings; *se*, semicircular enclosure; c_1, c_2, cribs or pounds.
5. Kubkub in operation; diagrammatic.

FIG. 6. Aboy bating in operation; diagrammatic. lb_1, lb_2, Large bancas; sb_1, sb_2, sb_3, sb_4, sb_5, sb_6, sb_7, sb_8, small bancas.

7. Different ways of paying out the panglambang; diagrammatic. *a*, Operating in pairs and enclosing a floating school; *b*, operating individually, *c*, operating in pairs and enclosing a submerged school. sb_1, Starting buoy of outfit No. 1; sb_2, starting buoy of outfit No. 2; p_1, panglambang of outfit No. 1; p_2, panglambang of outfit No. 2; tb_1, terminal buoy of outfit No. 1; tb_2, terminal buoy of outfit No. 2; b_1, banca of outfit No. 1; b_2, banca of outfit No. 2.
8. Accessories of a panglambang outfit. *a*, Starting buoy; *b*, terminal buoy; *c*, panglurok, a wooden plunger.
9. The sapiao in operation; diagrammatic. *b*, Banca to which net is attached; *n*, net; *sl*, scareline; b_1, attending banca.

Daet
Mercedes
Daet Point
Basud
Angas
Metpogloog
CAMARINES NORTE
Apuao I.
Apuao Grande I.
Canton I.
Quinapagyan I.
Malasugue I.
Caringo I.
BUTAUANAN BAY
Bulauanan I.
SAPENITAN BAY
Siruma I.
Siruma
SIRUMA BAY
Matandang Siruma (Bubuan)
S. Miguel I.
Bito
Sulpa
Daligan
Looc River
Caglilog
Buenavista
Lalawigan
SAN MIGUEL BAY
Lup[illegible] R.
Tinambac
Coagluhan R.
Cauil I.
Begacay
Sibobo
Cabgan I.
Tanglar I.
Tanglar Pt.
Sabang Calabanga
Calabanga
CAMARINES SUR
Punta Calabanga
Belongey
Cabusao
Castillo
Pandan
Barceloneta
Manga R.
Cotmo
Sipocot
Bicol River
LEGEND
M=muddy; S=sandy; rky=rocky; Co=coral; hrd=hard; sft=soft; fne=fine; Coral reefs
10 fathom line
5 fathom line
Capital; Municipality; Barrio; Provincial Boundary
Flood
Ebb
MILES
14°
50′
13
40′
123°
10′
20′

PLATE 1.

PLATE 2.

PLATE 3.

PLATE 4.

PLATE 5.

PLATE 6.

PLATE 7.

BOOKS

Acknowledgment of all books received by the Philippine Journal of Science will be made in this column, from which a selection will be made for review.

RECEIVED

AYKROYD, W. R. Vitamins and other dietary essentials. 2d ed. London, W. Heinemann (Medical books) ltd., 1936. 226 pp. Price, 7s. 6d.

BEVAN-BROWN, C. M. Individual psychology: theory and practice, by C. M. Bevan-Brown, G. E. S. Ward, and F. G. Crookshank. London, C. W. Daniel co., ltd., 1936. 79 pp. Price, paper, 2s. 6d.

BLATZ, W. E. Nursery education; theory and practice. New York, W. Morrow & co. inc., 1936. 365 pp., tables. Price, $3.50.

British museum (Natural history). Instructions for collectors No. 3. Reptiles, amphibians and fishes. 5th ed. London, Printed by order of the Trustees of the British museum, 1936. 15 pp., illus. Price, 4d.

BRUMPT, E. Précis de Parasitologie. Paris, Masson et cie, Editeurs, 1936. 2 vols., plates, figs. Price, 200 fr.

COLWELL, JOHN. Daily log for physicians. Champaign, Illinois, Colwell publishing co., 1936. Price, $6.

COPPLESON, V. M. Clinical handbook for residents, nurses and students. 2d ed. Australia, Angus & Robertson ltd., 1936. 205 pp. Price, 6s.

COUTIERE, HENRI. Connais-toi ou la physiologie sans pleurs. Paris, Librairie polytechnique Ch. Beranger, 1936. 174 pp.

DAVIS, J. E. Principles and practice of recreational therapy for the mentally ill. New York, A. S. Barnes & co., 1936. 206 pp. Price, $3.

DENHAM, H. J. Increased production in agriculture. Oxford, Hall, The Printer ltd., 1932. 35 pp. Price, 1s.

DRABBLE, J. Textbook of meat inspection. Australia, Angus & Robertson ltd., 1936. 353 pp., illus. Price, 21s.

DUERK, HILARION. Psychology in questions and answers. New York, P. J. Kenedy & sons, 1936. 230 pp. Price, $1.50.

FERGUSON, BURR. Facts and phagocytes; the story of the development of hydrochloric acid therapy. Ohio, Youngstown, Medical success press, 1936. 270 pp., illus. Price, $5.

GEYER, JOHN C. Textile waste treatment and recovery. A survey of present knowledge concerning the treatment and disposal of waste waters produced in the textile industries. Washington, D. C., The Textile foundation, inc., 1936. 118 pp., figs. Price, paper, $1.

GHOSH, RAKHALDAS. A treatise on materia medica and therapeutics, including pharmacy, dispensing, pharmacology, and administration of drugs. 14th ed. Calcutta, Hilton & co., 1936. 724 pp., illus., table. Price, Rs. 7, As. 8, or 12s. 6d.

GREENWOOD, MAJOR. The medical dictator and other biographical studies. London, Williams and Norgate ltd., 1936. 213 pp. Price, 7s. 6d.

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UNDERHILL, FRANK P. Toxicology or the effects of poisons. Thoroughly revised by Theodore Koppanyi. 3d ed. Philadelphia, P. Blakiston's son & co., inc., 1936. 325 pp. Price, $2.50.

WARDEN, CARL J. Comparative psychology: a comprehensive treatise. Vol. I. Principles and methods, by Carl J. Warden, Thomas N. Jenkins and Lucien H. Warner. New York, The Ronald press co., 1935. 506 pp., illus. Price, $4.50.

REVIEWS

Deserts on the March. By Paul B. Sears. University of Oklahoma press, Norman, Oklahoma, 1935. 231 pp. Price, $2.50.

This book could be regarded as a text on soil conservation. It is written in a style that makes for easy reading and for continued interest. As a demonstration of the injurious effects of improper utilization of soil, and the measures that must be taken to arrest the continued destruction wrought by the injurious forces of nature, it is the most complete seen so far. The whole object of this book is to present to the reader the conditions that exist with regard to soil and the forces at work, and to demonstrate that, for the continued benefit of mankind, a balance of nature must be maintained.—H. C.

The Chemists' Yearbook, 1936. Founded by F. W. Atack and edited by E. Hope. Sherratt & Hughes, Manchester, England, 1936. 1257 pp. Price, 21s.

The eighteenth edition of this handbook contains a considerable amount of physical and chemical data. To bring the book up to date, extensive revisions have been made in the chapters dealing with essential oils, tanning materials, dairy products, and related subjects. The analyses of sulphuric-acid-treated oils, alcohols, and wetting agents have been added. Modern methods are given for the analysis of leather, coal, liquid and gaseous fuels, lubricants, ceramic materials, tobacco, and numerous other products. It is undoubtedly an excellent compilation, and very useful for ready reference.—A. P. W.

Trail-Blazers of Science. By Martin Gumpert. Translated from the German by Edwin L. Shuman. Funk and Wagnalls Co., New York, 1936. 306 pp. Price, $2.50.

This book contains a group of essays giving the life stories of some half-forgotten pioneers of scientific research, men who lived at different periods from the sixteenth to the twentieth cen-

tury. Among the prominent names mentioned are Vesalius, the founder of anatomy; Servetus, the discoverer of the minor circulation of the blood; Galileo, who worked out the laws of falling bodies; Lamarck, founder of the theory of the evolutionary origin of species; Mayer, discoverer of the law of conservation of energy. The book ends with some notes about Dr. Harvey Cushing, the brain surgeon who is regarded as a type of the future scientist.

These essays are made unusually interesting by the local color and setting which they give. They point out very clearly that in the early centuries there was always opposition to genius and to the development of science.—A. P. W.

Our Insect Friends and Foes and Spiders. A Series of Fascinating Stories of Bee, Ant, Beetle, Bug, Fly, Butterfly, Moth, and Spider Life. Published by The National Geographic Society, Washington, D. C., 1935. 252 pp., illus. Price, $2.50.

In this book the National Geographic Society has succeeded in bringing forth a most complete collection of information on the most common insects of interest to man. The information is presented in a popular style that can easily be understood by the layman. The book is especially interesting and instructive to students of natural history and to all lovers of nature. For teachers of biology, the book should be most helpful. In the home it should be a source of enjoyment and recreation, as well as education. The book is bound in durable maroon cloth, gold-embossed, and has 64 pages of colored plates and 161 illustrations. There are nine interesting chapters with a foreword by the President of the society and editor. The book is provided with an index.—G. M.

Foods and the Law; Manual for the Business Man on the Laws of the United States. By Alexander P. Blanck. Peter Smith, New York, 1935. 246 pp. Price, $2.50.

The first part of this book is devoted to citations from the food laws and their interpretation by government rulings and court decisions. The second part reproduces the entire body of federal laws relating to food, conveniently arranged.

Food laboratories engaged in the enforcement of the food laws, food manufacturers, and others interested in foods will find in this book a valuable guide. It is written in clear and plain language, by an informed and scholarly lawyer.—F. D. R.

Spanish influence on the Progress of Medical Science with an Account of the Wellcome Research Institution and the Affiliated Research Laboratories and Museums Founded by Sir Henry Wellcome. The Wellcome foundation, London, England, 1935. 121 pp.

This book is a condensed summary of facts of great importance to the history of medicine, especially mediæval medicine, showing clearly and forcefully the part that Spain has played in the progress of medical science. Several Moorish-Spanish physicians were accorded deserved honor, all from the Moorish cities of Cordova and Toledo, which were then great centers of learning. Aben Guefit, Albucasis, Avenzoar, Averroes Maimonides are among the great names mentioned. The establishment of charitable institutions was given great impetus, so that today we see them in great numbers not only in Spain, but everywhere she carried her influence as a colonizer and evangelizer. The Spain of the 15th, 16th, and 17th centuries likewise produced other great men, like Servet, who discovered pulmonary circulation; Vesalius, the father of scientific anatomy, although non-Spanish, was in the service of Charles V. The discovery of cinchona through the agency of Spanish subjects ushered in the era of modern specific medication.—J. P. B.

Earthquakes. By Nicholas H. Heck. Princeton University press, Princeton, New Jersey, 1936. 222 pp. Price, $3.50.

The author says in his preface with regard to the nature of this work: "Seismology has made great advances in recent years, but not for years has a broad and comprehensive picture been presented for the general reader with a discussion from every viewpoint. The purpose of the present volume is to meet this need and accordingly it is not for the specialist." Captain Heck has very adequately and satisfactorily accomplished his purpose.

Seismology underwent rapid and important developments after the World War. Now the science may be said to have reached a stage where a popular presentation can be made which will not become out-of-date too quickly. We believe that this volume will fill a long-felt need, and will serve its purpose for many years.

The nature of earthquakes, as well as their detection, noninstrumental and instrumental, is explained in several chapters. Then follow discussions on the distribution of earthquakes, conspicuous earthquakes with emphasis on those of the United

States, earthquake-resistant construction, and a final chapter on the history of seismology. I have had many requests in recent years for just such a book as Captain Heck has made available.
—W. C. R.

Why Bring That Up? A Guide to and from Seasickness. By J. F. Montague. The Home Health library, New York, 1936. 130 pp. Price, $2.

Sailing across the sea is but to divorce oneself from the boresome daily routine, and the discomfort which one may meet during this trip is of no moment since seasickness can be prevented or at least minimized. The first thing the author of this book counsels is to avoid rush in the preparation for travel, as the getting of a passport, the preparation of income tax receipts and other pertinent matters concerned with leaving the country, for he considers a tired mind and body as a good and ready recipient for the dreaded seasickness. The parties given by friends before sailing should be avoided as much as possible, for they are conducive to seasickness. The author lays stress on the evacuation of the large intestine by means of a enema before going to ship, and some pertinent preparation for use at sea, as belladonna plaster, tablets of sodium barbital (pento) or sodium nitrite tablets, and enema bag, and a pair of smoked gogles. At sea he counsels the avoidance of overeating, alcohol, coffee, and also of strong odors, as of perfumes and tobacco smoke. He advises attendance of all parties given on board but not indulgence of drinking bouts, on participation in all games on deck, and frequenting going the deck, so as to have the fresh sea breeze. Observation of these rules will accustom the body to the movement of the boat. Other chapters deal with the when, where, and how to travel. The places discussed are mostly around the east coast of the United States and those reached by crossing the Atlantic Ocean.—C. D. A.